TOTAL IMPLANT

KometaBio

Tissue Engineering

Smart Dentin Grinder

¡NO TIRE LOS DIENTES DE SUS PACIENTES!

Úselos para **generar injerto autólogo** de la más alta calidad y proveer excelentes resultados a sus pacientes.

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ARGUMENTOS CONVINCENTES

Mejores resultados estéticos predecibles

El injerto autólogo es el estándar de oro de la industria dental

El mejor funcionamiento de injerto a corto y largo plazo.

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ARGUMENTOS CONVINCENTES

Estética superior

- *Casi no hay reabsorción del injerto de dentina debido a su densidad*
- *Osteoinductivo y osteoconductivo, regenera en hueso tipo II*

El estándar de oro: hueso autólogo

- *El cuerpo lo reconoce como suyo*
- *No hay riesgo de transimición de enfermedades (Como pudiera existir en injertos de cadáver y animales.)*
- *La composición del hueso y la dentina son 99% iguales*

El mejor funcionamiento de injerto a corto y largo plazo.

- *Debido a la Anquilosis, reduce el tiempo de restauración a la mitad.*
- *Induce la regeneración ósea debido a la atracción de las células progenitoras.*
- *Reduce el tiempo de restauración.*

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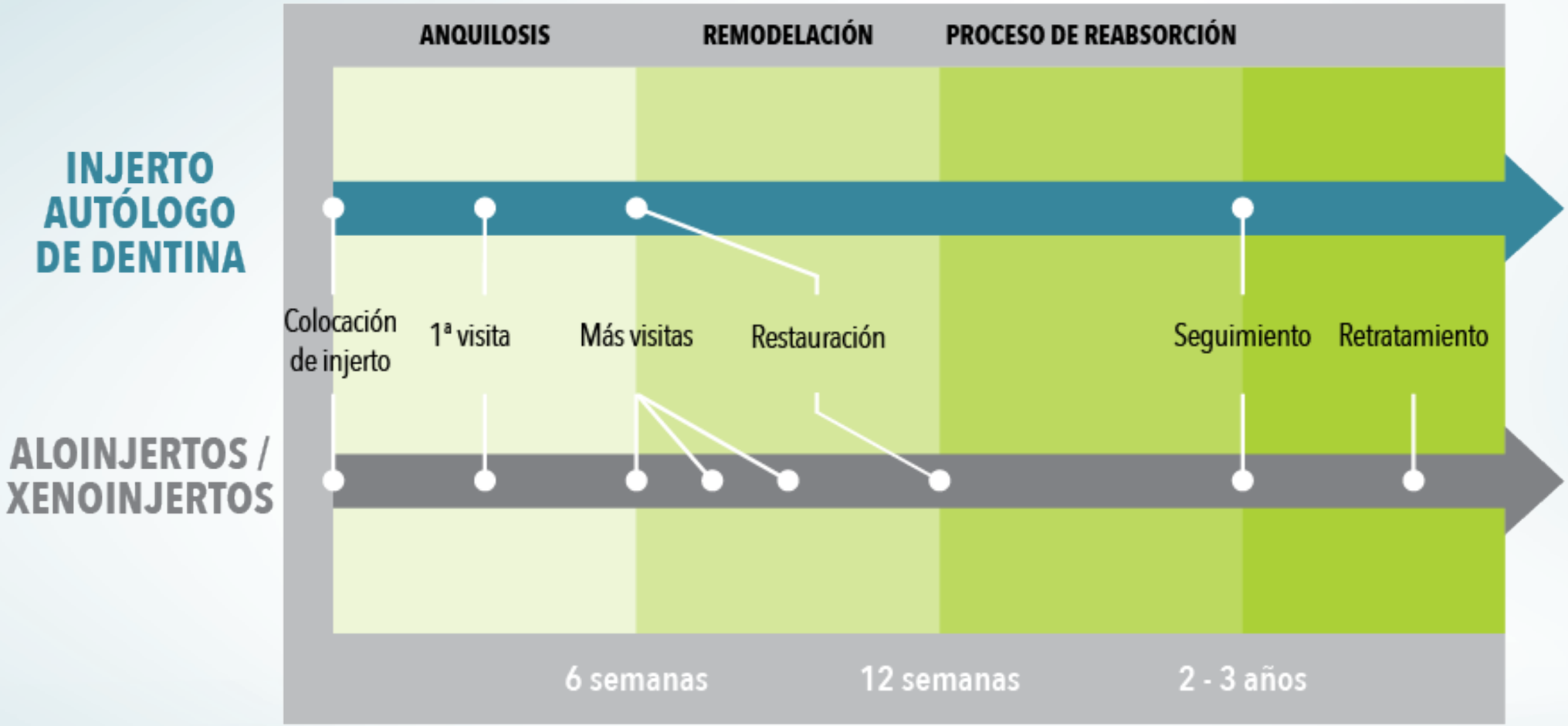
LÍNEA DE TIEMPO



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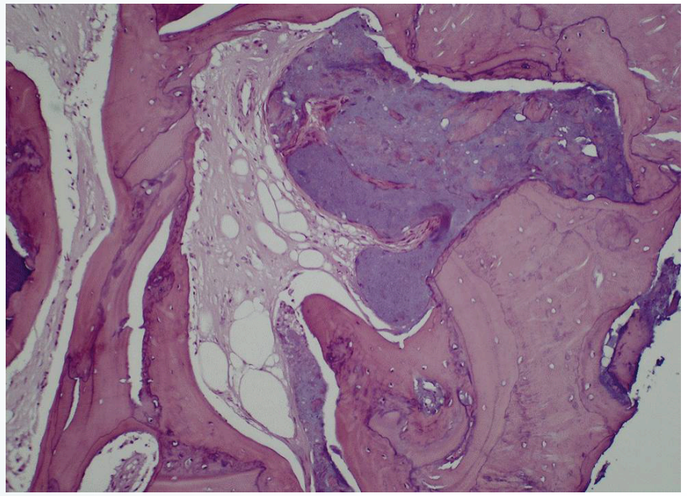
Anquilosis

Fusión de dentina con el hueso



- Esta característica no la tiene ningún otro hueso más que el autógeno.
- Esta fusión hace que el dentista pueda poner un implante mucho más rápido.

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BENEFICIOS CLÍNICOS 1

- ✓ Se crea hueso cortical en la mitad del tiempo que en un hueso no autógeno, esto significa que:
  - Se pueden colocar implantes mucho más rápido
  - Se genera estabilidad primaria y secundaria en menos tiempo
  - Se genera tejido blando de excelente calidad
  - Reduce el tiempo de restauración
  - Se fusiona rápidamente con el hueso alrededor

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BENEFICIOS CLÍNICOS 2

- ✓ Elimina el riesgo de enfermedades, infección, inflamación y rechazo.
  - Hueso autógeno es reconocido por el cuerpo como propio.
  - Contiene factores de crecimiento
  - Reduce riesgos en demandas por infecciones cruzadas.
- ✓ Reduce la reabsorción vertical debido a la densidad de la dentina.

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BENEFICIOS ESTÉTICOS

- ✓ Debido a que el injerto de dentina se reabsorbe lentamente a través de los años este se sincroniza con el mecanismo natural de remodelación ósea por lo que la calidad de hueso es superior.

- ✓ El injerto autólogo es el estándar de oro de la industria dental

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BENEFICIOS ECONÓMICOS

- ✓ Menos visitas de seguimiento al consultorio: menos horas sillón. Esto se da debido a que la restauración se realiza en menor tiempo.
- ✓ El costo de un consumible es de $65 USD, con esto se obtiene un injerto de la mayor calidad posible. (Los injertos con características osteoinductivas tienen un costo muy elevado).
- ✓ Elimina el costo de complicaciones asociados a infecciones cruzadas, inflamación, reacciones adversas, enfermedades, etc.
- ✓ Mucho más fácil explicar al paciente que se le va a injertar un hueso de su propio cuerpo que uno de cadáver o de origen animal.

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PUNTOS IMPORTANTES 1

- Fusión contra remodelación: Injerto fresco con células progenitoras, proven osteogénesis (formación de nuevo hueso) solo hueso autógeno tiene esta capacidad.
- Resultados – Hueso cortical: NO sabemos de otro injerto que pueda mostrar resultados de hueso cortical con esos resultados.
- Acelera el proceso de cicatrización: la cicatrización se obtiene en la mitad del tiempo, por lo que la reabilitación se puede realizar mucho más rápido.
- Se ha hecho investigación de la dentina desde 1970, pero no había una máquina que pudiera injertarla como hueso.
- Tasa de éxito más elevada de cualquier otro injerto: debido al proceso de fusión en la anquilosis.

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PUNTOS IMPORTANTES 2

- Cantidad abundante de injerto: un diente unitario puede generar de 1 a 3.5 cc
- No hay posiblidad de transmisión de enfermedades
- Fácil de explicar a los pacientes
- Los dientes que tienen endodoncia (contraindicación) son aproximadamente el 22%
- Menos visitas al consultorio: menos “costo de sillón”.
- Se puede almacenar el injerto de dentina por tiempo indefinido.
- Se puede utilizar el diente extraído con anterioridad

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COMPARACIÓN

Dentina Autógena: Osteogénica

- Promueve crecimiento de hueso nuevo.
- Se fusiona con hueso existente (Anquilosis)
- Forma hueso **tipo II**
- Tiempo para colocar un implante **6 semanas** aprox.

Aloinjertos, Xenoinjertos y Sintéticos: No osteogénicos

- Guía el crecimiento de tejido óseo pero no inmediatamente.
- Se debe esperar a la remodelación ósea
- Forma hueso **tipo IV**
- Tiempo para colocar un implante **12 semanas** aprox.

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OBJECIONES 1

- "Es muy caro"
  - El tiempo de restauración es más rápido.
  - Menos chequeos en el consultorio (entre la extracción y la restauración.)
  - Mucho más barato que los injertos de mediana calidad, siendo de la mejor calidad en el mercado.
  - No se puede comparar con todo tipo de injertos. La calidad del injerto que se obtiene aquí sólo es comparable con injertos autógenos osteoconductivos.

- "Largo tiempo de preparación"
  - Se prepara en 15 minutos.
  - En menos tiempo acompletas la restauración, por lo que el tratamiento es más corto y se obtiene el pago del paciente en menos tiempo también.

- "No se puede usar con dientes con endodoncia"
  - Es realmente la única contraindicación que se tiene, se pueden usar incluso dientes con enfermedades periodontales.
  - Según las estadísticas sólo el 30% al 35% de los dientes que se extraen han tenido una endodoncia.
  - En un futuro también se van a poder utilizar dientes con endodoncia

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OBJECIONES 2

- "*Dientes* son lo mismo que *hueso*"
  - Esto no es verdad. Diente e injerto son 99% lo mismo (50% hidrioxiapatita y 50% matriz orgánica, colágeno y fibrina).
- "Hay que retirar el esmalte"
  - No hay que retirarlo, debido a que el esmalte se comportaria como injerrto de hidrioxiapatita
- "Hay que despulpar el diente"
  - El limpiador actúa a nivel celular, por lo que esto no es necesario.
- "Hay que limpiar el diente en pulpas necróticas"
  - No es necesario porque el limpiador actua a nivel celular, eliminando virus, bacterias, y cualquier otro microorganismo.

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Referencias

Herramientas	Donde encontrarlas
Estudios	www.kometabio.com
Casos científicos	www.kometabio.com, asi como en catálogos en PDF.
Referencias (Lideres de opinión)	List: Maurice Salama, Grodon Christensen, Kois, Smiler, Pikos, David Kim, Paul Rosen, Jack Krausen, Ziv Mazor, Fromovich.
Países con presencia de Kometa bio	EUA, España, Israel, Canadá, Inglaterra, Italia, Francia Rumania, Korea, México.
Videos	En www.kometabio.com y en www.youtube.com bajo el nombre de KOMETABIO.
Guías de usuario	En www.kometabio.com
Demo	Contactanos si necesitas una demostración física del producto.

Manufacturer	Brand	Type	Price per 1 cc in $
KometaBio	Smart Dentin Grinder Chamber Kit	Autologous	$ 58
Ace Surgical (HS)	AlloGRO-DBM	Allograft	$ 67
Straumann	Allograft GC-Mineralized	Allograft	$ 70
Salvin	OraGraft	Allograft-Cortical Mineralized	$ 80
Salvin	OraGraft	Allograft – Cortical Demineralized	$ 84
BioHorizon	MinerOSS – Cortical		$ 84
Meisinger ArtOSS	NanoBone granules	Synthetics	$ 90
Straumann	Allograft-DBM	Allograft	$ 90
Ace Surgical (HS)	SynOSS	Synthetics	$ 100
Ace Surgical (HS)	NuOSS Cancellous	Xenograft	$ 105
Ace Surgical (HS)	AlloOSS Cortical	Allograft	$ 114
Ace Surgical (HS)	AlloOSS Cancellous	Allograft	$ 114
Salvin	OraGraft	50%-50%	$ 119
Ace Surgical (HS)	NuOSS Cortical	Xenograft	$ 120
Salvin	OraGraft	Allograft-Cancellous Mineralized	$ 120
Ace Surgical (HS)	BioXEN	Xenograft	$ 126
BioHorizon (HS)	MinerOSS – Cancellous or mix	Allograft	$ 134
Zimmer	PurOSS	Allograft	$ 136
Septodont	RTR	Synthetics	$ 140
Orthogen	NanoGen	Synthetics	$ 148
Bottis	Cerabone	Xenograft	$ 150
NovaBone	PerioGlas	Synthetics	$ 150
Salvin	AlloSculpt	DBM Cortical Putty	$ 179
Meisinger ArtOSS	NanoBone putty	Synthetics	$ 200
Keystone Dental	OCS	Xenograft	$ 210
Geistlich	Bio-OSS	Xenograft	$ 215
NovaBone	NovaBone	Synthetics	$ 215
Straumann	Bone Ceramics	Synthetics	$ 220
Ker (HS)	Bioplant	Synthetics	$ 225
Zimmer	Pro-DBM (putty bone chips)	Allograft	$ 226

Price Comparison

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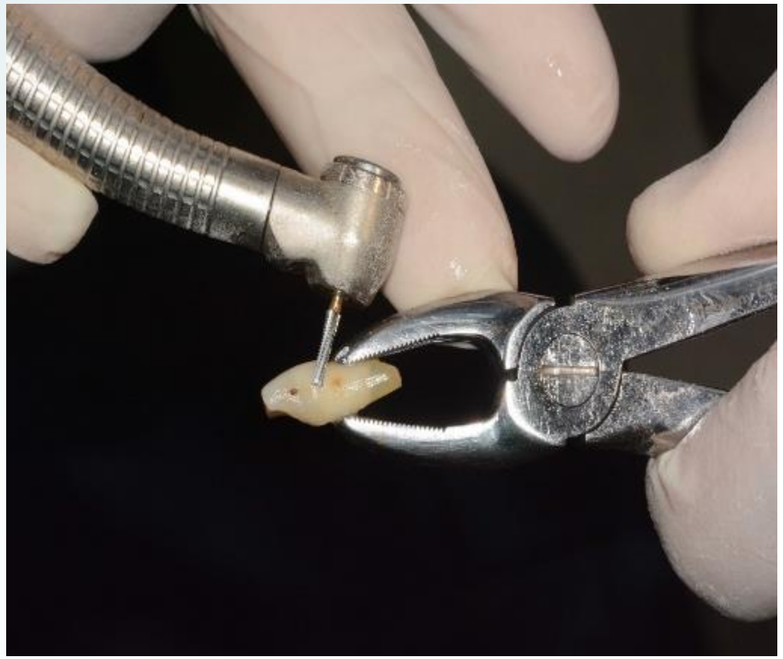
Limpieza de superficie



Utilice una fresa de carburo para remover cavidades, materia artificial y para limpiar el diente extraído para que quede un diente limpio.

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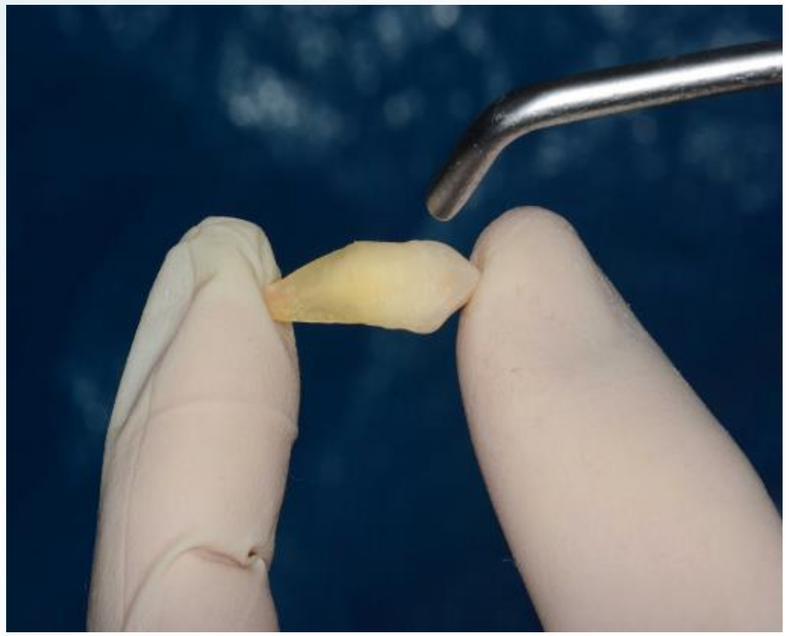
Secar el diente



Seque el diente con aire. Esto reduce drásticamente la cantidad que será perdida en el proceso de molición del diente.

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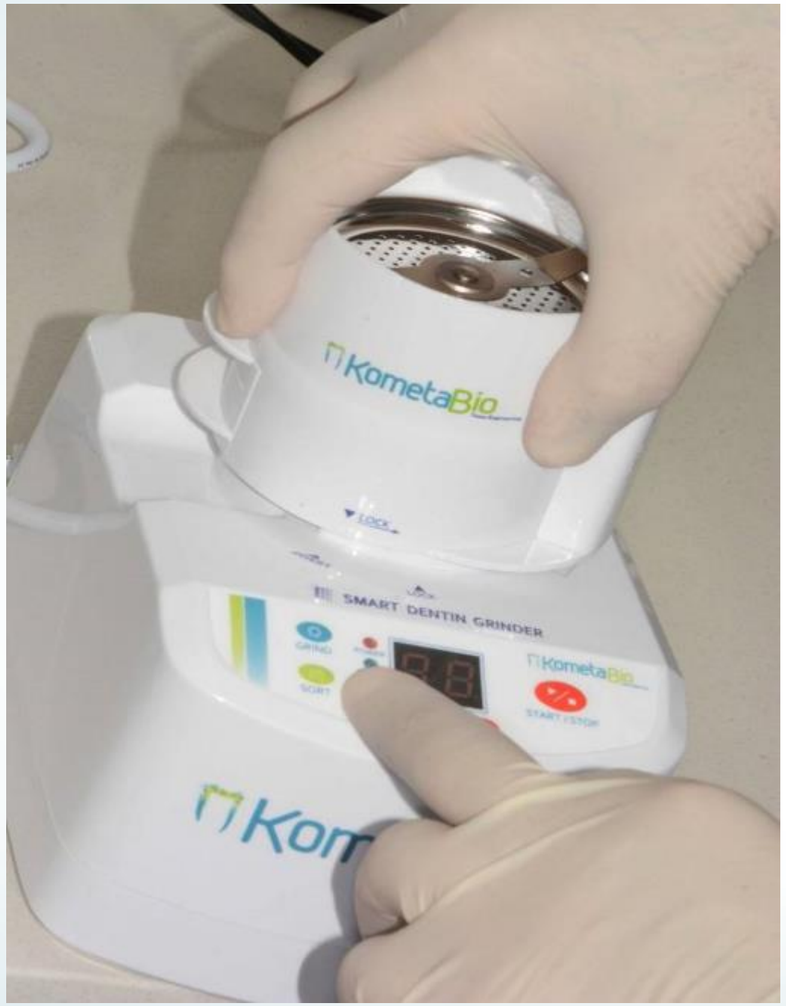
Colocar el consumible



Coloque el consumible en la parte superior del Kometa Bio. Alinee la flecha pequeña con la flecha del centro del molino. Gire el consumible para fijar su posición. Una vez fijo, la flecha indicadora en el consumilble tendrá que estar alineada justo en el centro con la fleche del centro del molino.

Min.
15
12
9
6
3
0

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Grind and sort

Encienda el moledor. Coloque los dientes preparados en el moledor al lado de las cuchillas. Cierre la tapa de la cámara y gire hacia la izquierda para que encaje en su lugar . Pulse el botón GRIND . El indicador GRIND se va a iluminar. Pulse la UP y / o DOWN tantas veces como sea necesario con el fin de establecer el tiempo de molienda preferido o conveniente.

Es muy recomendable establecer el tiempo de moler de 3 segundos. Pulse el botón SORT. El indicador SORT se va a iluminar. Pulse la UP y / o el botón DOWN tantas veces como sea necesario con el fin de establecer el tiempo de clasificación preferido. Le recomendamos que ajuste la clasificación de tiempo a 20 segundos .

Pulse el botón START para iniciar el proceso de volición. Si quedan piezas grandes, pulse el botón START de nuevo para moler por otros 3 segundos y para SORT por otros 20 segundos. Asegúrese de que no hayan quedado partículas de dentina dentro de la cámara del molino.

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Extract graft

Saque el cajon superior del compartimiento, el cual contiene partículas de entre 300 - 1200 micros. Si usted siente que no es suficiente el injerto, puede añadir los gránulos del compartimiento inferior, los cuales son menores de 300 micros , pero sin duda se puede utilizarlas en combinación con las partículas más grandes.

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Aplicar el limpiador

Vierta el contenido del compartimiento del cajón superior en uno de los contenedores adjuntos. Verter el limpiador suministrado en el recipiente con las partículas y llene hasta cubrirlas. Cierre la tapa del contenedor girando. Dejar las partículas en la solución de limpieza durante 10 minutos a temperatura ambiente. Utilizando una gasa de algodón, absorba la solución.
Verter el fosfato salino (PBS) en el recipiente. Llenando aproximadamente la mitad de este. Agite el recipiente suavemente y dejar actuar aproximadamente de 2 a 3 minutos. Utilizando una gasa de algodón, absorba el exceso de solución de PBS. La dentina partículas está lista para el injerto inmediato.

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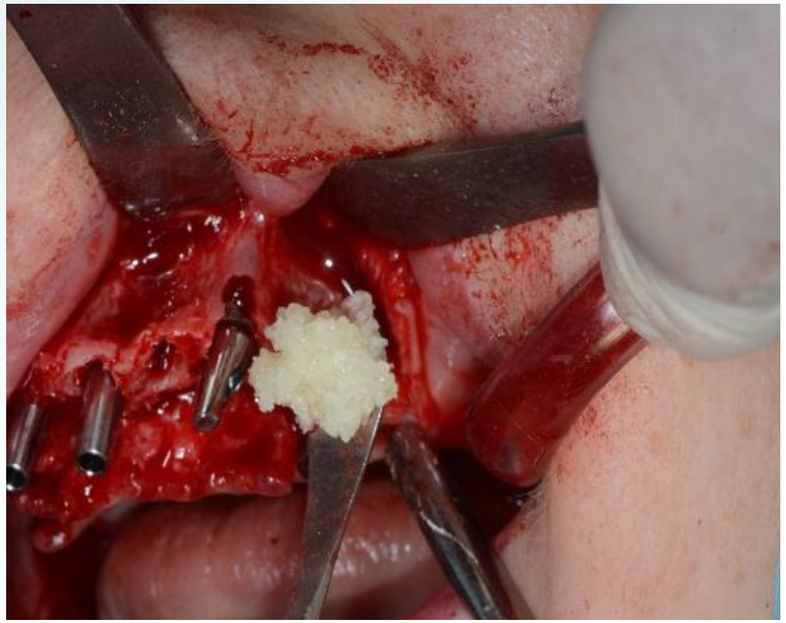
Place graft



Coloque el injerto de dentina humedo en el sitio donde desee regenerar, de la misma forma que coloca cualquier otro tipo de injerto.

Min.
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9
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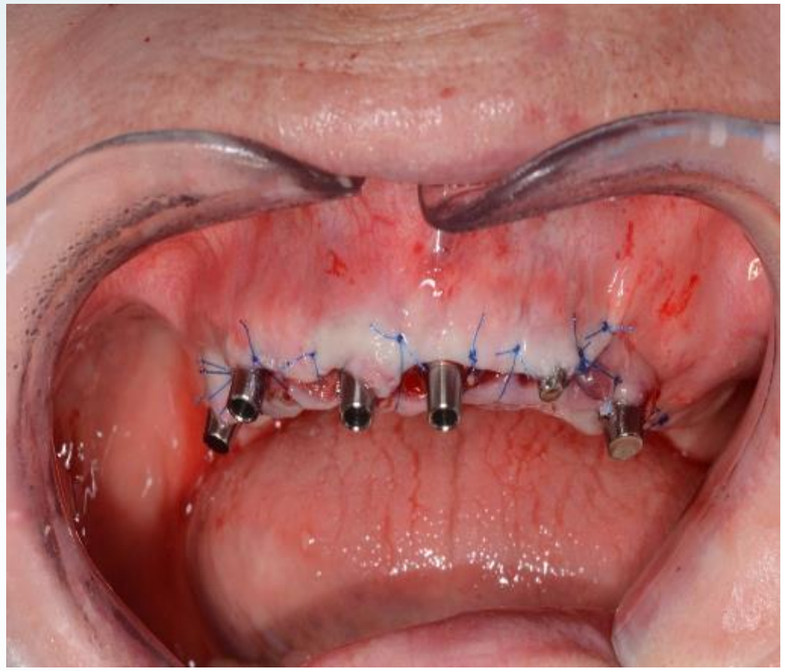
Sutura



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TOTAL IMPLANT

"Cada vez que usted haga una extracción, no tire los dientes que extrajo, piense en nosotros. Pues puede utilizar esos dientes como injerto autólogo de la más alta calidad y mejorar la estética de su paciente a largo plazo".

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TOTAL IMPLANT

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Tissue Engineering

Processing extracted teeth for immediate grafting of autogenous dentin

Drs. Itzhak Binderman, Gideon Hallel, Casap Nardy, Avinoam Yaffe, and Lari Sapoznikov investigate an alternative use for extracted teeth

Tooth extraction is one of the most widely performed procedures in dentistry, and it has been historically well documented that it can induce significant dimensional changes of the alveolar ridge.

In their review, Horowitz, et al. (2012), stated that less ridge resorption occurs when alveolar ridge preservation procedures are used, compared to leaving fresh alveolar sockets without placing graft material. If performed inadequately, the resulting deformity can be a considerable obstacle to the esthetic, phonetic, and functional results.

In dentistry, allogeneic bone and synthetic mineral materials are the main source for grafting in bone. However, fresh autogenous bone graft is still considered the gold standard since it exhibits bioactive cell instructive matrix properties and is non-immunogenic and non-pathogenic, in spite of the need for harvesting bone and possible morbidity resulting from it.

It is well-known that jawbones, alveolar bone, and teeth develop from cells of the neural crest and that many proteins are common to bone, dentin, and cementum (Donovan, et al., 1993; Qin, et al., 2002). It is, therefore, not surprising that dentin, which comprises more than 85% of tooth structure, can serve as native bone grafting material.

Interestingly, Schmidt-Schultz and Schultz (2005) found that intact growth factors are conserved even in the collagenous extracellular matrix of ancient human bone and teeth.

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Dr. Gideon Hallel is in private practice in Tel Aviv.

Dr. Casap Nardy works in the departments of maxillofacial surgery at Hebrew University of Jerusalem.

Dr. Avinoam Yaffe works at the Hadassah Faculty of Dental Medicine, Hebrew University of Jerusalem.

Dr. Lari Sapoznikov is in private practice in Tel Aviv.

Educational aims and objectives

This article aims to demonstrate an application that uses freshly extracted teeth as an autogenous grafting material in implant patients.

Expected outcomes

Implant Practice US subscribers can answer the CE questions on page 42 to earn 2 hours of CE from reading this article. Correctly answering the questions will demonstrate the reader can:

- Identify the procedure involved in processing extracted teeth into graft material.
- Realize the potential benefits this material offers to clinicians placing implants.
- See how to prepare for immediate grafting teeth without root canal fillings, which have been extracted due to advanced periodontal bone loss or other reason.
- See how autogenous dentin particulate can serve as a superior grafting matrix for augmenting bone in maxillary sinuses.

Methods for processing bovine dentin into particulate and sterile grafting material for preserving of alveolar bone have been described and used in several animal studies (Fugazzotto, et al., 1986; Nampo, et al., 2010; Qin, et al., 2014). It is, therefore, evident that teeth can become grafts that are slowly and gradually replaced by bone (Hasegawa, et al., 2007).

Currently, all extracted teeth are generally considered clinical waste and, therefore, are simply discarded. Recently, however, several studies have reported that extracted teeth from patients, which undergo a process of cleaning, grinding, demineralization, and sterilization, can be a very effective graft to fill alveolar bone defects in the same patient (Kim, et al., 2010; Kim, et al., 2011; Murata, et al., 2011). However, this procedure is extremely time-consuming since the graft is only ready several hours or days after extraction.

This article, therefore, aims to present a modified procedure that employs freshly extracted teeth in a clinical setting by recycling them into bacteria-free particulate autogenous mineralized dentin for immediate grafting.

A Smart Dentin Grinder® (SDG) (KometaBio) was devised, which grinds and sorts extracted teeth into dentin particulate of a specific size. A chemical cleanser is then applied to process the dentin particulate into a bacteria-free graft over the course of about 15-20 minutes.

This novel procedure is indicated mainly in cases when teeth are extracted because of periodontal reasons and for partially or totally impacted teeth. Teeth that have undergone root canal fillings should not be employed in this procedure because of the risk of contamination by foreign materials. On the other hand, crowns and fillings can be reduced, and the clean dentin of the tooth crown can be processed for immediate grafting.

Method: from extraction to grafting particulate dentin

Teeth without root canal fillings, which have been extracted due to advanced periodontal bone loss or other reasons, such as wisdom teeth extraction or orthodontic indications, can be prepared for immediate grafting.

Immediately after extraction, restorations like crowns and fillings should be cut off or removed. Carious lesions and discolored dentin, or remnants of periodontal ligament (PDL) and calculus should be reduced by tungsten bur (Figures 1A and 1B). The authors have found that high-speed tungsten carbide burs are most efficient for this process. The roots could be split in case of multi-rooted teeth.

Clean teeth, including crown and root dentin, are dried by air syringe and put into the grinding sterile chamber of the newly designed Smart Dentin Grinder (Figure 2A). The SDG can grind the roots in 3 seconds

and then uses the vibrating movement of the grinding chamber to sieve any particles smaller than 1,200µm into a lower chamber that collects particles between 300µm and 1,200µm (Figure 2B). Particles smaller than 300µm fall into a waste drawer, as this fine particulate is not considered to be an efficient size for bone grafting. This grinding and sorting protocol is repeated to grind the remaining teeth particles left in the grinding chamber, still collecting particles between 300µm and 1,200µm.

The particulate dentin from the drawer is immersed in basic alcohol for 10 minutes, in a small sterile glass container. The basic alcohol cleanser consists of 0.5M of NaOH and 30% alcohol (v/v) for defatting, dissolving all organic debris, bacteria, and toxins of the dentin particulate.

Figure 3 shows the efficiency of the cleanser to dissolve all the organic debris from dentin particulate, including dentin tubules. The scanning electron microscope (SEM) picture shows open and clean tubules after 10 minutes of cleanser treatment (Figure 3C). After decanting the basic alcohol cleanser, the particulate is washed twice in sterile phosphate-buffered saline (PBS). The PBS is decanted, leaving wet particulate dentin ready to graft into freshly extracted sockets, alveolar bone defects, or in procedures involving augmenting the maxillary sinus.

The process from tooth extraction until grafting takes approximately 15-20 minutes.

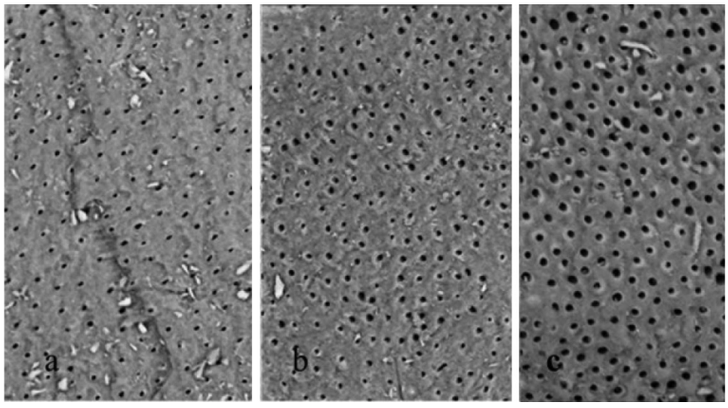
It should be noted that the efficiency of selecting the dentin particulate of specific size for grafting is more than 95%. It is also obvious that the volume of the particulate dentin is more than twice of the original root volume. Alternatively, the wet particulate can be put on a hot plate (140ºC) for 5 minutes to produce dry, bacteria-free particulate autologous dentin that can serve for immediate or future grafting procedures.

Results: clinical evaluation

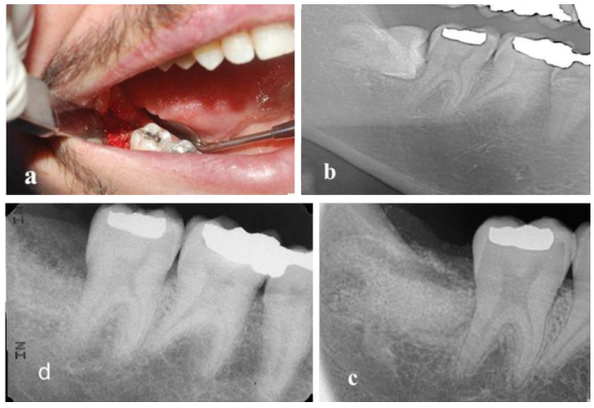
Over a period of 2 years, more than 100 dentists have employed the present procedure for preparing autogenous dentin particulate from extracted teeth for immediate grafting in the same patient. It should be noted that teeth that underwent root canal treatment were discarded. When intact teeth were processed, the enamel and cementum were included. Figures 4 to 7 show a number of typical case presentations where teeth were extracted and processed into bacteria-free particulate

Figures 1A-1C: From extraction to clean particulate: 1A. Tooth after extraction, debris, and calculus. 1B. Same tooth after reducing debris with tungsten carbide bur. 1C. Particulate dentin after grinding and sorting. The particulate dentin size is 300µm-1200µm

Figures 2A-2B: Smart Dentin Grinder and drawer with particulate dentin of 300µm-1200µm size ready for cleanser treatment: 2A. Smart Dentin Grinder and sorter. 2B. Drawer that collects particulate dentin after grinding and sorting. The size of particles in this drawer is 300µm-1200µm



Figures 3A-3C: 3A. Scanning electron microscope (SEM) x750 of particulate dentin when cleanser is added. 3B. SEM x750 of particulate dentin at 3 minutes after treatment with cleanser. 3C. SEM x750 of particulate dentin at 10 minutes after treatment with cleanser. Note the wide-open tubuli openings. Bacteriological tests revealed no bacteria growth at this point



Figures 4A-4D: Extraction sites at LR8 filled with particulate dentin prepared from extracted tooth by the Smart Dentin Grinder procedure: 4A. Clinical view of the extraction site. 4B. X-ray of impacted tooth LR8. 4C. After extracting the LR8, particulate of extracted tooth was prepared and placed in extraction site. 4D. By 4 months, the particulate and newly formed bone completely restored the void next to the distal root of tooth LR7

autogenous tooth dentin for immediate grafting in same patient.

Wisdom tooth extraction

A total of 16 wisdom teeth, including partially impacted, horizontally impacted, and caries-affected teeth, were processed using the SDG procedure during this study. Figure 4 shows a horizontally impacted LR8 tooth that was in close proximity to the distal root surface of the LR7, creating a deep void. The surgically extracted LR8 exposed the distal root surface of the LR7, almost denuded from bone tissue. The LR8 was processed immediately into the particulate graft, which totally filled the extraction site (Figure 4C). Healing and recovery after the surgical procedure and grafting took place without complications.

A follow-up after 4 months revealed a normal pattern of marginal gingiva around the LR7. Probing was normal: 1 mm-2 mm in depth. On the X-ray distal to the LR7, new bone and particulate dentin was integrated into bone, completely restoring the extraction site and distal bone support of the LR7 (Figure 4D).

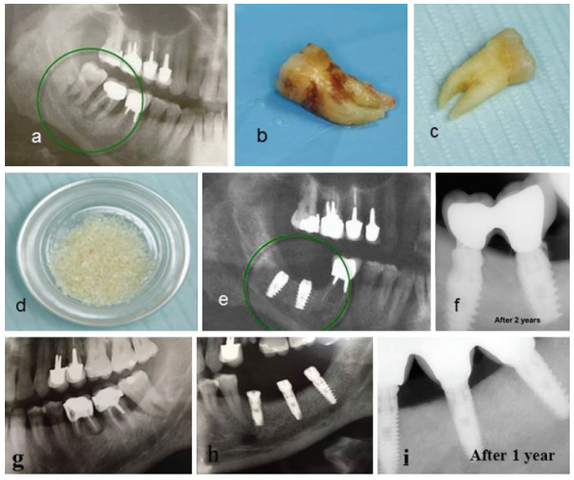
Periodontal extractions

A further 37 teeth were extracted because of poor periodontal attachment, bone loss, and mobility. Figure 5 illustrates the case of a 56-year-old male patient with a localized, advanced periodontal condition in posterior parts of the mandible.

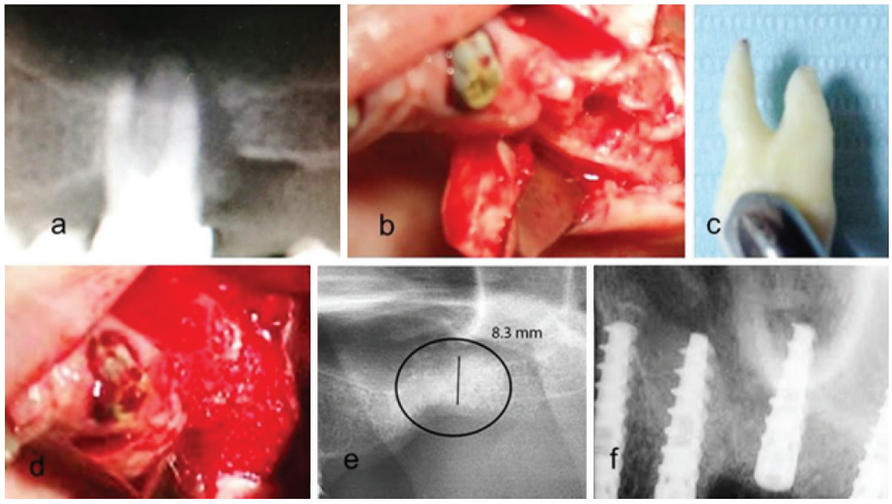
The LR7 and LR8 were extracted, and the granulation tissue was removed exposing bone tissue walls. The LR7 had a root canal filling and was therefore discarded. The LR8 was processed into particulate dentin by the SDG device and prepared for immediate grafting in the extraction sites.

The grafting of one tooth produced sufficient volume of particulate dentin to overfill the extraction site of both sockets. A Choukroun PRF (platelet rich fibrin) membrane was prepared from the patient's blood (Cieslik-Bielecka, et al., 2012) to cover the graft. The mucoperiosteum was sutured to the PRF, avoiding tension of tissues. Improved healing was achieved because of the PRF membrane. Approximately 2 months later, two implants were placed, followed by a cemented bridge of LR7-LR8 crowns.

After 2 years, clinical and X-ray follow-up revealed very radiopaque bone integrated into implants, most possibly consisting of bone-dentin but producing a very solid support for implants (Figure 5). A similar procedure was performed in the same patient's lower left jaw. X-rays showed bone loss around the LL6-LL8 (Figure 5G). Two months after grafting with the particulate dentin from tooth LL8, three implants were inserted (Figure 5H), and 1 year later, the bone density and bone level with no signs of bone resorption at the crest after restoration could be observed (Figure 5J).



Figures 5A-5I: Periodontally involved teeth at LR7, LR8, LL6, LL7, and LL8 with extensive alveolar bone loss. Immediately after extraction, only teeth LR8 and LL8 were employed for particulate dentin and immediately used to augment the extraction sites: 5A. X-ray before extraction of LR7 and LR8. 5B. LR8 before mechanical cleaning. 5C. LR8 after cleaning with tungsten carbide. 5D. Particulate dentin after cleanser treatment, ready to graft. 5E. After 2 months, two implants were inserted in the augmented extraction sites. 5F. Radiograph at 2 years – note dense bone and lack of bone loss next to implant. 5G. X-ray showing bone loss around teeth LL6-LL8. 5H. Three implants were placed, 2 months after grafting with particulate dentin from tooth LL8. 5I. One year later, note the bone density and bone level with no signs of bone loss next to implants



Figures 6A-6F: 6A. Periodontally involved tooth UL6. 6B. Alveolar bone after extraction – note the oroantral opening. 6C. The UL6 after extraction and cleaning. 6D. After preparation of particulate from tooth UL6, the socket was grafted and the oroantral opening filled with particulate dentin. 6E. After 2 months, 8.3 mm height of bone was achieved with a high density of dentin-bone. 6F. After 3 months, three implants were placed, and immediate solid anchorage was achieved

Sinus lifts

Autogenous dentin particulate can serve as a superior grafting matrix for augmenting bone in maxillary sinuses, as presented in the next case.

The patient presented with alveolar bone loss, with infrabony pockets that extended into the maxillary sinus of tooth UL6 (Figure 6). The UL6 was extracted, cleaned, and processed into bacteria-free particulate dentin (Figure 6D). An immediate grafting of the extraction socket was performed, and the tract into the sinus was occluded by the particulate dentin. Closure of the wound and sutures of mucoperiosteum flap was performed.

Healing was normal, and 3 months later, an alveolar ridge of minimum 8.3 mm height was achieved, allowing placement of three implants. It should be noted that one molar — the UL6 — produced at least 2 cc of particulate dentin, which allowed augmentation of the extraction socket and part of the sinus.

Moreover, we found that autogenous dentin grafting allowed the placement of implants after 3 months in the upper jaw because the new bone that was integrated with particulate dentin produced a solid support for implants.

Loading of implants followed. During preparation of the site for implant placement, a core of bone was recovered from the grafted socket site. The histology revealed new bone integrated with grafted dentin, producing a bone-dentin interface and connectivity (Figure 7).

Discussion

More than 40 years ago, autogenous teeth were routinely transplanted into extraction sockets when possible. It is evident that transplanted teeth that are ankylosed in the jawbone undergo replacement resorption over 5 to 8 years (Sperling, et al., 1986).

In addition, it is well documented that avulsed teeth that are implanted back into their sockets undergo firm reattachment to bone, which is formed directly on root dentin or cementum, leading to ankylosis (Andersson et al, 1989). An ankylosed root is continuously resorbed and replaced by bone, eventually resorbing the entire root, while the alveolar process is preserved during this period and later.

In a recent review, Malmgren (2013) stressed that in ankylosed teeth that are treated by decoronation, the alveolar ridge is maintained in the buccal/palatinal direction, while vertical height is even increased (Park, et al., 2007). Our results reveal similar interaction between the mineralized dentin and osteogenic cells that attach and produce mineralized bone matrix directly on the dentin graft.

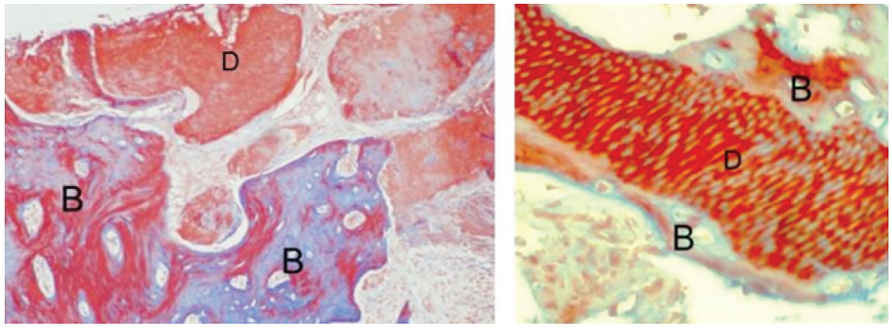
A tooth bank in Korea provides a service that prepares autogenic demineralized dentin matrix graft in block or granular types (Kim, et al., 2011; Murata, et al., 2011; Kim, 2012), delaying the grafting procedure from several hours to several days and, therefore, requiring an additional surgical session.

Although demineralized dentin exposes matrix-derived growth and differentiation factors for effective osteogenesis, the newly formed bone and residual demineralized dentin are too weak to support implant anchorage. In contrast, the SDG procedure allows preparation of bacteria-free particulate dentin from freshly extracted autologous teeth, ready to be employed as autogenous graft material immediately.

Mineralized dentin particles have the advantage of maintaining mechanical stability, allowing early loading after grafting in fresh sockets and bone defects. Moreover, in spite of its delayed inductive properties (Yeomans and Urist, 1967; Huggins, et al., 1970), the mineralized dentin is firmly integrated with newly formed bone, creating a solid site for anchorage of dental implants. In fact, our clinical data indicates that implant insertion and loading can be performed in both lower and upper jaws 2 to 3 months after dentin grafting.

Since the mineralized dentin is very slowly remodeled (Yeomans and Urist, 1967; Kim, et al., 2014; Andersson, 2010) in comparison to cortical bone or most biomaterials, the esthetic and structure pattern of the alveolar crest and mucoperiosteum is maintained for years. Teeth and jawbone have a high level of affinity, having a similar chemical structure and composition. Therefore, the authors and others (Kim, et al., 2011; Murata, et al., 2011; Kim, 2012) propose that extracted non-functional teeth or periodontally involved teeth should not be discarded any more.

Extracted teeth can become autogenous dentin, ready to be grafted within 15 minutes after extraction. We consider autogenous dentin as the gold standard graft for socket preservation, bone augmentation in sinuses, or filling bone defects.



Figures 7A-7B: 7A. A histology section (trichrome stain) of a core of bone tissue that was drilled out from upper jaw 3 months after grafting with autogenous dentin. 7B. A higher magnification of the dentin-bone interface. Note how the dentin with its tubules (D) is surrounded by newly formed bone matrix (B)

Disclosure

The Smart Dentin Grinder is distributed by Kometa Bio. Drs. Itzhak Binderman and Lari Sapoznikov helped to develop the Smart Dentin Grinder and have shares in Kometa Bio Ltd., the company responsible for distributing the device.

Drs. Gideon Hallel, Casap Nardy, and Avinoam Yaffe have no conflict of interest. They participated actively in providing clinical cases and their follow-ups. IP

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How to Transform Extracted Teeth into an Autologous Bone Graft in a Single Dental Appointment

In most cases the tooth socket is significantly remodelled after the extraction of a tooth. Filler material is required to be placed in the socket before a dental implant or prosthesis can be put in place in order to maintain the bone volume and thus preserve aesthetics and allowing normal restoration. **Drs Dominique ESTRADE and Emmanuel METIVIER**

The ideal bone filler material is osteoconductive, osteoinductive and osteogenetic[1,2]. This is why the autologous bone graft, with its known limits, is considered to be the reference graft. There is, however, another autologous biomaterial that has the same properties and same consistency as cortical bone that we have readily available at our dental surgeries when extracting teeth –

The same composition as bone

Dentin is formed from the same ingredients as bone, i.e.:

- Type I collagen (more than 90% of its organic compounds) which plays a key role in the bone formation
- Bone Morphogenetic Proteins (BMP) which promote bone formation[3,4,] and other non-collagenous proteins

Experimental studies on animals and subsequent clinical studies have highlighted

Dr Itzhak Binderman, a bone tissue specialist of the University of Tel-Aviv and Dr Lari Sapoznikov, have developed a system allowing an extracted tooth to be transformed into decontaminated dentin particulate, ready for autologous implantation into their newly liberated tooth sockets or bone defects, in an easy three-step procedure:

Smart Dentin Grinder: Tooth grinding and dentin particulate sorting system. The 250 to 1200 µm particles are collected in the drawer and then decontaminated before being re-implanted in the tooth socket for an autologous graft.

Initial Case

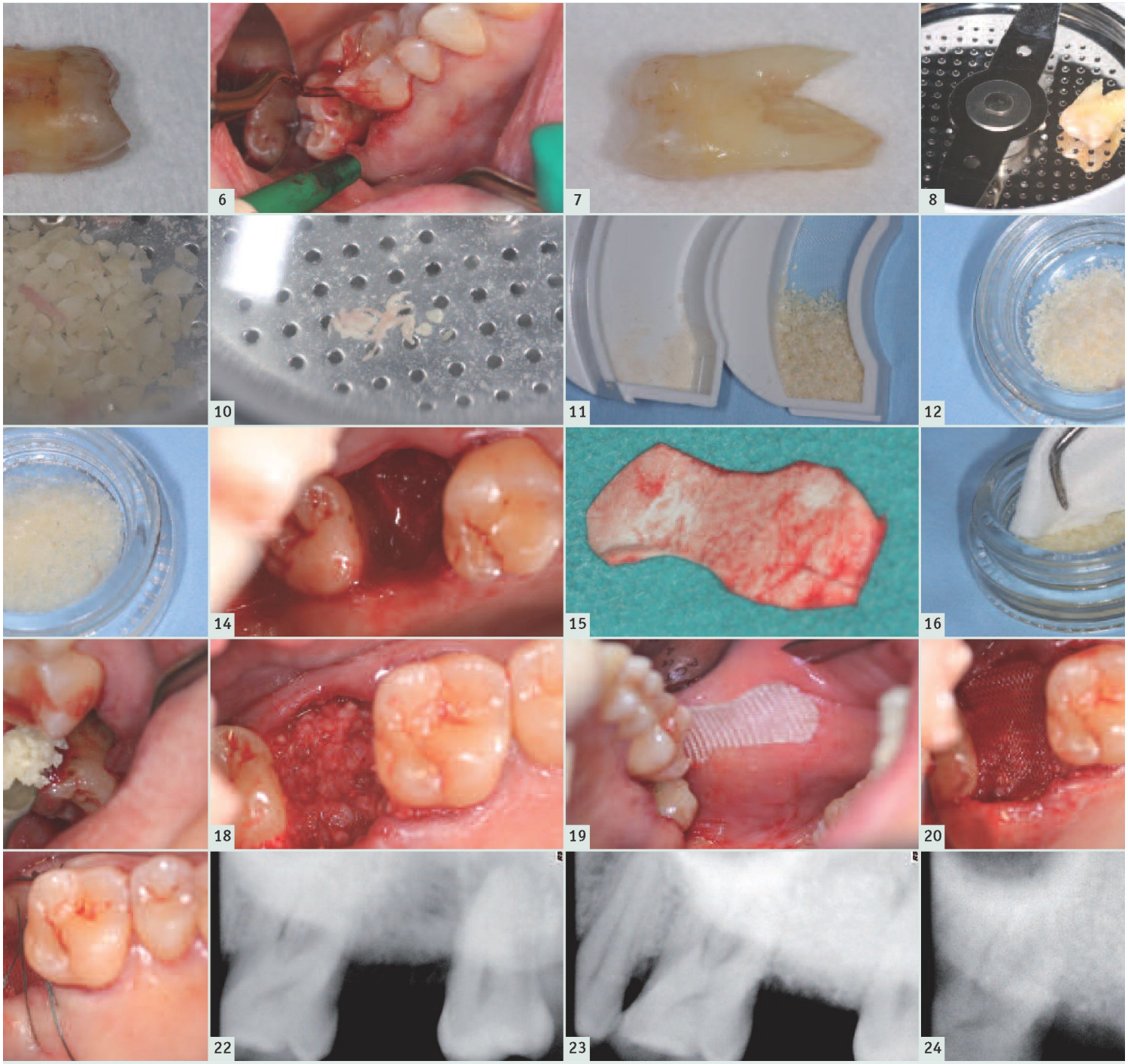
The osteoconductive, osteoinductive and osteogenetic properties of dentin and its ability to incite bone formation.[5-6]

The concept, however, is not new since we have known for decades that a tooth that is extracted and re-implanted may undergo ankylosis. This ankylosis is caused by the osteogenic cells present in the tooth socket from which the tooth was extracted, which attach to the radicular surface of the tooth and then differentiate by turning into bone. The bone formation cycle causes slow root resorption until the root has completely disappeared and is replaced by bone after five to ten years.

A first solution, allowing dentin to be used as a bone graft material was developed in South Korea and Japan over 10 years ago. However, the complexity of the protocol limits it to hospital use or alternatively requires the services of a specialised company.

1. Extraction of the Tooth, elimination of food substances and removal of organic debris. The enamel does not have to be removed since it is made of hydroxylapatite.
   NB. Teeth that have undergone an endodontic treatment cannot be used in this procedure.
2. Grinding (3 secs) and particulate sorting (20 secs) using the Smart Dentin Grinder (Photo A) device.
3. Decontamination using a cleanser, followed by rinsing in a saline solution.

The system comprises a motor unit onto which the sterile, single-use grinding chamber is attached. These chambers grind the teeth that have been cleaned and sort the particulate by size. The granulate for the graft (250 to 1200 µm in diameter) is collected in the top compartment of the unit on the left of the chamber and then placed in a sterile cup



a tooth that has not undergone endodontic treatment. The bone loss is mainly associated with periodontal problems. Significant non-structural interference on the inn and 27. / ***Fig. 2:*** *Significant bone loss as regards the palatine root of 27. Pocket of approximately 9 mm in size highlighted by the periodontal probe. /* ***Fig. 3:*** *The peri 6 does not show any bone decay (3 mm).* ***Fig. 4:*** *Palatine incision on the mesiolingual corner of 26 to the distolingual corner of 28.* ***Fig. 5:*** *The tooth immediately a ly free of all residues: desmodontal remainder of the periodontal and apical granuloma. /* ***Fig.6****: The liberated tooth socket is carefully cleaned: all inflammatory tiss ed from the radicular surface of the adjacent teeth and apical curettage is carried out. /* ***Fig. 7:*** *The tooth is cleaned using a tungsten carbide mill rather than a diamon composite, glass ionomers) materials are removed as are all the infected and affected caries and all gingival, desmodontal and pathological tissue adhesions. /* ***Fig. 8:****Pl sterile grinding chamber of the SMART DENTIN GRINDER. The first sifting allows all particulates smaller than 1200 µm to pass through. /* ***Fig. 9:*** *All the dentin and enam passed through the first sieve by the end of the first grinding and sorting sequence (3 seconds and 20 seconds, respectively) . The particulates that are larger than ing and sorting cycles so as to obtain as much graft material as possible. /* ***Fig. 10:*** *Only a few pulp-like elements remain in the grinding chamber after various crushi cycles is preferred over a single, long crushing session, which is much less efficient. /* ***Fig. 11:*** *The particulate to be used for the bone graft (250 µm - 1200 µm in di*

Easily Create Autogenous Graft From EXTRACTED TEETH

Did you know that tooth & bone composition are almost the same?

Introducing the **NEW Smart Dentin Grinder** from Golden Dental Solutions that is designed to effortlessly create safe autogenous gold standard graft from extracted teeth in minutes. Regenerate bone faster by leveraging growth factors and bioactive properties of dentin which improve healing time, tissue response and patient acceptance.

STEP 1: PREPARING THE EXTRACTED TOOTH

Using a tungsten bur, remove all artificial material (e.g., amalgam, composites, decay, etc.) as possible from the tooth so that only clean tooth dentin remains. As for decay or organic elements, there's no need to eliminate it entirely. If traces of decay remain – these will all be dissolved by the cleanser and wash process outlined below in Steps 4 and 5.

Once this is completed the tooth should be well dried using your air, as it will need to be placed into the Smart Dentin Grinder dry.

STEP 2: PREPARING THE SMART DENTIN GRINDER

Remove one of the disposable chambers from its sterile packaging and place properly onto the Smart Dentin Grinder device. Turn on the device, set the grinding and sorting timers based on the provided guidelines and push Start.

STEP 3: REMOVING & PLACING GRAFT

Open the top drawer on the side of the device to access the particulate that was created. Carefully place the graft material from the drawer into the provided glass container.

STEP 4: CLEANSING PARTICULATE DENTIN GRAFT

Using the pre-measured vial of Dentin Cleanser, pour the Dentin Cleanser into the glass container containing the particulate. Let the particulate and Dentin Cleanser sit in the glass container for 10 minutes. After the soaking period, use gauze to remove as much of the Dentin Cleanser from the glass container as possible.

STEP 5: RINSING THE PARTICULATE DENTIN GRAFT

Using the pre-measured vial of Dentin Wash, pour the Dentin Wash into the glass container containing the particulate. Let sit in the glass container for 3 minutes. Just as in Step 4, after the soaking period, use gauze to remove as much of the Dentin Wash from the glass container as possible.

The dentin graft is now ready for use.

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TOP 10 FAQs:

1 Can dentin really be used as a graft?

Absolutely. The research shows that dentin is very similar to bone as for its chemical and biological composition. Furthermore, due to its strength it acts as the ultimate scaffold.

2 Is Dentin graft better than allograft?

Yes. It is better than allograft due to its autologous nature, same proteins, and no immunogenic response. It is also denser than allograft. Being osteogenic it rapidly differentiates into bone. As a result the site will heal a lot quicker and be ready for restoration much faster in comparison to allograft. Most importantly it promotes new bone regeneration at the site. You will experience very little graft resorption if any with this type of graft.

3 Why would I spend 15 min. making Dentin graft when I can immediately use allograft?

It is true, your time is valuable. We understand this. The process is not complicated and we find that most often your staff will prepare the graft for you. The longest portion of the process is the 10 minute cleansing-soaking process, where you can be doing other things while waiting. Beyond this aspect, I think you will agree that autogenous graft is the best graft clinically for your patient. This graft provides superior care, extraordinary bone formation and superior soft tissue response which is absolutely worth the small investment of your assistants time. There are also financial considerations to consider, where a single tooth can create three times the volume in graft material. You can achieve typically 1cc from an incisor and 3-4cc's from a molar or premolar. For more complex cases or multiple graft sites, the graft material cost can add up quickly with an allograft. This savings should be taken into consideration.

4 How do I sterilize the graft for use?

Our Dentin Cleanser Kit is very effective in eliminating bacteria and any organic matter. There are a couple easy steps in the process to prepare the graft using first a Dentin Cleanser (0.5m of sodium hydroxide with 20% ethanol) followed by a Dentin Wash (phosphate buffered saline). Coupled with the fact that the Dentin graft is autologous, the risk of infection is close to zero and certainly lower than other pre-packaged grafts that are commonly used today.

5 How fast does the Dentin Graft remodel and be replaced by bone? Healing time?

Dentin does not resorb but rather it is fused (ankylosed) by bone. Together the fused bone-dentin matrix will remodel very slowly which will maintain the superior aesthetics of the restoration for much longer than other grafts.

In theory, do not change your best practices at first, but your experience will show you that with the Dentin graft you will be getting strong bone formation in about half the time of any other graft. The studies have found that the mandible site can be ready in as quick as seven (7) weeks and the maxillary site can be ready in three (3) months. This is much more efficient than the typical three (3) months for the mandible and six (6) months for the maxilla that most dentists would wait using an allograft or other non-autogenous graft.

6 Do I grind the entire tooth? Crown, root, pulp, enamel and all?

Yes. You will grind the entire tooth after removing any amalgam or composite during the mechanical cleaning stage. Some dentists do remove the crown or enamel aspect prior to grinding the tooth, but this is absolutely not a necessary aspect.

7 What is the particulate size created from this device?

250-1200 microns.

8 How much graft material can I get from a single tooth?

You will get three times the volume of the tooth, where typically you will create 1cc from an incisor and 3-4cc's from a molar or premolar.

9 How much research has been done to support this concept?

Rest assured that a lot of clinical research has been completed to support this concept. The research on this specific product includes both scientific studies as well as clinical studies over the last five (5) years. There is a lot more supporting research on this general idea that spans across three decades.

10 What if the tooth has amalgam, composites or deep decay?

All these elements need to be stripped off the tooth by mechanically cleaning the tooth with a tungsten bur prior to placing the tooth in the grinder. The dentist should try and get as much of it off the extracted tooth as possible. As for decay or organic elements, there's no need to eliminate it entirely. If traces of decay and such remain – these will all be dissolved by the cleanser and wash process.