Abstract
The patient is a 45 year old asian female. She does not smoke nor consume alcoholic beverages. The patient is in excellent health and her medical history is non-contributory. She has no known drug allergies nor system diseases.

Initial Situation
The patient presented to Dr. O’Brien with the maxillary right lateral incisor (#7) horizontally fractured apical to the gingival margin (Fig. 1, 2). The patient recalled that about five years ago, her previous dentist had performed root canal therapy and restored the tooth with an all-ceramic crown. On the day the patient presented to Dr. O’Brien, all coronal tooth structure was fractured off which the patient had kept in a plastic bag. Insufficient coronal tooth structure remained (no ferrule effect) to support a post-core and new restoration. The patient was given several options to replace this tooth and selected to have the tooth extracted and replaced with a dental implant restoration. On the day of this emergency visit, Dr. O’Brien provisionalized the tooth by placing a stainless steel post into the root canal, created a resin core and retrofitted the existing all-ceramic crown to this resin core and remaining tooth structure. Temporary cement was then used to lute the existing crown back on to the tooth. The occlusion was carefully adjusted to protect this interim restoration (Fig. 3). A referral was immediately made to Dr. Kim for surgical planning.

Patient’s Chief Complaint
When the diagnosis of a poor long-term restorative prognosis was given to the patient, several options to replace the tooth were provided. She opted to have the tooth extracted and replaced with a dental implant restoration. The patient was also unhappy with the aesthetics of the existing crown on #8 maxillary right incisor (Fig. 4, 5).

Description of Planning
After obtaining a CT scan and discussing the prosthodontic and surgical options for #7, it was decided to extract the tooth and immediately place a dental implant into the extraction site (Fig. 6). The plan for tooth replacement on the day of extraction included immediately provisionalizing the dental implant (immediate function) or using a bonded restoration to replace the missing tooth. Due to ill-fitting margins, bacterial leakage and an unaesthetic appearance, the plan for #8 included endodontic re-treatment and a new crown.

Description of the Performance of the Surgical Operation
The surgical site was anesthetized with local anesthesia. Without raising a flap around #7, the tooth was removed by splitting the root in medio-distal sections. Osteotomy was carried out in a conventional protocol utilizing the osteotomy twist drills. Extreme care was used to orient the implant position in the palatal quadrant of the extraction socket. This was done by visual aid of silk suture tied around the adjacent teeth in a “Fig. of 8” as suggested by Dr. Nigel Saynor (Cheshire, UK) (Fig. 7). A Straumann® depth gauge (2.2 diameter) was utilized to ensure adequate depth in the apico-cononal dimension as crestal bone was not directly visible. Straumann Bone Level 3.3 mm x 12 mm NC, SLActive® Roxolid® was placed in the prepared osteotomy site (Fig. 8). Adequate initial clinical stability was achieved and verified with an Osstell device, which registered 68 ISQ (implant stability quotient, Osstell, Gothenberg Sweden) (Fig. 9). The facial gap in the extraction socket was grafted with a composite graft of autogenous bone.
collected from osteotomy drills and with xenograft. Bone was added with an Osstell SmartPeg intact in the implant connection to avoid particles entering the implant connection compartment. Facial soft tissue of the affected teeth (#5–9) was augmented for thickness and bulk with freeze dried dermal allograft with a Vestibular Incision Subperiosteal Tunnel Access technique (VISTA). The dermal graft was enhanced with a double layer of platelet-rich fibrin membrane. The VISTA access was relaxed adequately to allow for coronal advancement of the periosteal-mucogingival complex and closed only at the vertical VISTA access on the facial aspect with 4.0 chromic gut suture.

Clinical Result Immediately After the Treatment
As verified by the Osstell unit, the initial primary implant stability was excellent and thus is was decided to complete the immediate implant provisionalization. The existing crown was modified and retrofitted/luted onto a Straumann temporary abutment making a screw-retained provisional (Fig. 10). The occlusion was adjusted so that there was no lateral contact with the opposing teeth in eccentric mandibular movements. The patient left the surgery looking almost exactly as she came in (Fig. 11–12).

Description of the Dental Lab Procedure
Over four months was allowed for implant osseointegration and stabilization of the gingival profile (Fig. 13). A customized fixture level impression coping was used to transfer the important gingival emergence profile developed by the provisional restoration to the master cast. A Straumann CARES® Variobase™ (shade L4 zeron®) custom abutment was used with a cement-retained zirconia ceramic crown for the definitive restoration. This abutment design offers the security and fit of a titanium implant-abutment interface with the aesthetics of a zirconia substructure. An extra appointment was used to try in the crown with unfinished porcelain and allow for optimal shade matching. Following adjustments needed to properly seat the crown, the definitive abutment screw was fully seated to 35 Ncm using a Straumann torque wrench. Teflon tape was used to obturate the screw access chamber and a resin cement was used to lute the crown to the implant abutment (Fig. 14).

Clinical Results After Placement of the Final Prosthesis
The gingival profile around the #7 implant restoration exhibits excellent health and aesthetics. The implant fixture and restoration show excellent stability (Fig. 15, 16). The restoration is not a mirror image of #10 due to the patient’s request, however, there is good aesthetic harmony and balance with the final prostheses and the patient’s natural dentition (Fig. 17, 18).

Why the Roxolid® for All implant(s) was chosen
Roxolid is a titanium-zirconium alloy that has been shown to be up to 50% stronger than pure titanium. The Roxolid alloy combined with the SLActive surface afforded the patient a durable and secure solution to replace her missing tooth. The Straumann implant components, in conjunction with the restoration fabricated, are designed to give the patient a smile that will last a lifetime.

Testimonial from Treating Clinicians About Roxolid as a Practice Differentiator
Using Straumann’s Roxolid has given us comfort and security when using dental implants in narrow interdental spaces. The increased alloy strength afforded by the combination of titanium and zirconium may be the reason we have not experienced any implant fixture fractures or complications related to implant design when using Roxolid narrow diameter implants.

Precise Details of the Straumann Products Employed
• Straumann Bone Level Ø 3.3 mm, NC, SLActive Roxolid with Loxim
• Straumann Cares Variobase custom abutment
• Straumann torque control device

Contributors
Gianmarco O’Brien, DDS
Dr. Gianmarco O’Brien is originally from San Francisco, California. He completed his Bachelor’s Degree at Santa Clara University. After college, Dr. O’Brien became interested in dentistry, worked as a dental technician and later earned his D.D.S. from the University of the Pacific School of Dentistry. Upon graduation, he was inducted as a member of the Omicron Kappa Upsilon and Tau Kappa Omega Dental Honor Societies, as well as the Phi Kappa Phi National University Honor Society, which is reserved for the top three overall graduates of each class. Following dental school, Dr. O’Brien pursued training in the dental specialty of Prosthodontics. He was accepted into the Advanced Graduate Prosthodontics Program at the University of California at Los Angeles School of Dentistry and completed his residency earning his specialist certificate. Dr. O’Brien was a clinical instructor at UCLA’s dental school for three years, and one year at the UCLA Center for Aesthetic Dentistry. He now focuses on full time clinical practice as a Prosthodontist in the cities of Orange and Los Angeles, California and lectures abroad on implant and aesthetic reconstructive dentistry.
Jin Y. Kim, DDS, MPH, MS, FACP

Dr. Jin Y. Kim is originally from Korea. He is a 1986 graduate of dental school at the University of Sydney, Australia. He received specialty training in periodontics at the UCLA School of Dentistry from 1995–1998. He is board-certified by the American Board of Periodontology, and the American Board of Oral Implantology. He is a diplomate and a fellow of International Congress of Oral Implantologists (ICOI) and the American Academy of Implant Dentistry. He was inducted to the Fellow of the American College of Dentists in 2012. He has spoken at national and international academic and clinical podiums, spanning over at least 26 different countries, and at 16 different dental schools world-wide. He is currently a lecturer at UCLA School of Dentistry, and is a past president of the Western Society of Periodontology (WSP). Dr. Kim is in private practice limited to Periodontics and dental implants in Diamond Bar and Garden Grove, California.

References

1 The 50% is calculated from material strength properties of TiZr (according to internal specifications) and Titanium Grade 4 (according to minimal tensile requirements of ASTM F67).
Fig. 1 Overview showing teeth and gingiva

Fig. 2 Close-up view of future implant site and adjacent teeth including gingiva

Fig. 3 Overview showing initial provisionalization when #7 fractured

Fig. 4 Close-up showing initial provisionalization when #7 fractured

Fig. 5 Palatal view showing #7 immediate provisionalization

Fig. 6 Periapical x-ray before treatment

Fig. 7 #7 Implant positioning

Fig. 8 #7 Roxolid for All fixture placement

Fig. 9 Ostell Device

Fig. 10 Existing crown used for immediate implant provisional

Fig. 11 Lateral view showing #7 immediate provisionalization

Fig. 12 Frontal view showing #7 Immediate provisionalization

Fig. 13 Provisionals #7 and #8 after osseointegration

Fig. 14 Straumann Variobase and Crowns

Fig. 15 Post-treatment periapical x-ray after implant superstructure integration

Fig. 16 Lateral perspective showing the emergence profile of the implant superstructure

Fig. 17 Close-up view of implant, adjacent teeth and gingiva after placement of implant superstructure

Fig. 18 Overview photograph showing teeth and gingiva after placement of the implant superstructure