For a predictable aesthetic result with an implant-retained restoration following tooth extraction, the biology of the healing extraction sockets must be considered (Quirynen et al 2007).

Recent clinical studies suggest that in most situations, immediate implants placement should not be considered in anterior sites since marked reduction of the alveolar ridge at the Pristine is always observed and therefore reconstructive procedures like guided bone regeneration may be necessary, before implant installation, to achieve an adequate aesthetic outcome (Huynh-Ba et al 2010).

In these studies (Sanz et al 2010, Ferrus et al 2010, Tomasi et al 2010), the inclusion criteria refer to the presence of an intact extraction socket with an anatomy suitable for implant placement following tooth removal. A buccal marginal bone border that deviated less than or equal to two millimeters from the expected “normal”
location and a potential facial fenestration at least three millimeters apical to the marginal bone crest were borderline for inclusion in the study. These criteria may have included such regions in type I or II bone according to the Elian et al (2007) classification or in type I of the Funato et al (2007) classification.

Differing from the surgical indications of Elian et al (2007) and Funato et al (2007), however, were the studies of Sanz et al (2010), Ferrus et al (2010), and Tomasi et al (2010), where a full-thickness flap was opened prior to site selection and classification. In these studies, measurements were performed by different examiners using a periodontal probe to the nearest millimeter and a manual caliper. Inter-examiner repeatability was not assessed.

Comparing these observations and methodologies, can be challenging for a clinician to propose a treatment plan with specific procedures or defined working time unless he or she has already opened a flap and extracted the tooth in question. As a matter of fact, most clinicians do not agree that a full-thickness flap procedure should be performed prior to tooth extraction.

The Importance of Study Design and Clinical Relevance

It is also important to consider the manner by which the results of a study are presented. When imprecise empirical methods are used in the collection of pertinent data (eg, probing expressed in millimeters) that are subsequently presented in terms of “mean” millimeters or percentages of volume lost, the clinician is significantly disadvantaged to draw applicable conclusions to his or her daily practice. For instance, the results presented by Botticelli et al (2004) show the marginal portion of the edentulous ridge was reduced buccolingually by 40%, which appears to be a considerable loss. Clinically this means, however, a reduction of 2.8 mm. Thus, with implant placement, the buccal reduction could be considered less than 1.6 mm — which is occasionally compensated for by the soft tissues. If such loss is expressed...
as a percentage, this will give practitioners the perception of considerable socket volume loss; in clinical reality this volumetric change represents an aesthetic alteration that may not be observed or may be restored with the application of additional techniques. Furthermore, it may be speculated that without immediate implant placement, bone loss could be even more pronounced.

Additionally, in the 2010 Sanz et al studies an appropriate healing abutment was installed and soft tissues were sutured following implant placement. After 16 weeks of healing, new full-thickness flaps were elevated and new measurements were recorded. The results documented a mean horizontal dimension change of 1.1 mm in the buccal aspect and 0.5 mm in the palatal aspect. Ultimately, this research did not evaluate if immediate implant placement was acceptable as a means to decrease bone resorption. To evaluate the influence of immediate implant placement in a fresh extraction socket, a study would have to be designed with implant placement in a given site and no implant at the contralateral site. As these investigators used two different variables in their study, a clinician cannot properly evaluate the effects of immediate implant placement on the pattern of bone resorption observed. In this instance, 93 patients were placed in a study that compared two implant designs installed in sites immediately after tooth extraction. Since this study was not designed to clarify any other factor the conclusions should be about the comparison of the two implant geometric designs. No other results may be extrapolated.

Using the same approach, Ferrus et al (2009) tried to identify factors that influenced buccal ridge alterations occurring at extraction sites followed by immediate implant placement. These investigators concluded that the thickness of the buccal bone wall and the dimension of the horizontal gap between bone wall/implant were the most relevant factors. If this was the only method of placing implants in fresh extraction sockets, however, this procedure was to be avoided. According to Ferrus et al,
in all such anterior sites guided bone regeneration or block bone grafts would be necessary. Again it is important to observe that in one group of this study 21% of the implants were placed in lateral incisor sites and with implants at least 4.5mm in diameter. In the other group 20% of the implants were placed in the lateral incisor area with most of the implants with 4.0mm diameter. When comparing anterior and posterior sites this observation must be considered and even so the differences between anterior and posterior were less than 0.7mm in all parameters (Ferrus et al 2010).

**Tooth Replacement in the Anterior Maxilla**

The dimensional changes experienced in the maxilla following tooth extraction have been previously described (Johnson 1969, Pietrokovski and Massler 1967, Schropp et al 2003). Immediate implant placement in the aesthetic zone with provisionalization has been described by Wöhrle (1998) without flap elevation. Over the past 15 years, two questions beg asking: Is there a faster, more non-invasive, predictable, and biological way to replace a tooth with an implant in such a clinical situation? Is it possible to use a different method of implant placement that can overcome this aesthetic inconvenience?

Bianchi and Sanfilippo (2004) performed immediate implant placement with an alloplastic bone material or resorbable membrane. Zitzmann et al (2001) used a porous bovine bone mineral matrix (ie, Bio-Oss, Osteohealth, Shirley, NY) for alveolar ridge augmentation and histologically described the dynamics of the biomaterial’s incorporation in fresh human extraction. Several studies have proposed the use of graft materials as means of ridge preservation during bone healing (Carmagnola et al 2003, Serino et al 2003, Nevins et al 2008).

In a randomized controlled trial using platform switching, Canullo et al (2010) concluded that marginal bone levels were better maintained at implants restored accordingly. Touati et al (2005), using the Nobel Curvy abutment (Nobel Biocare, Yorba Linda, CA) allowed more space at the supracrestal aspect of the implant abutment interface and demonstrated soft tissue growth and maintenance in the majority of treated sites. Additionally, Kan et al (2009) demonstrated the effect of additional methodologies (eg, soft tissue grafting and the placement of bovine allografts) between the implant surface and the internal aspect of the socket buccal wall when immediate implant placement and immediate provisionalization were used.
Thus, many different groups have studied different ways to achieve an optimal outcome with implant placement in the anterior maxilla — each suggesting that immediate extraction with immediate implant placement is now rarely the treatment of choice in the aesthetic zone. The procedure is, however, performed as a matter of routine with additional therapy (e.g., the use of a soft tissue grafting, particulate bone fillers) or with new abutment designs. These supplemental procedures are generally conducted by the surgical team in order to overcome aesthetic deviations from normal anatomical situations, i.e., primarily because of the operators’ lack of knowledge in correct diagnosis and/or case selection.

Additional Considerations

It is possible to postulate that variations in bone volume for implants placed in fresh extraction sockets are multifactorial (Table 1) and all influence the clinical results observed in an Elian et al Class I type of postextraction alveolus. The type of surgical procedure recently presented by Sanz et al (2010) and Ferrus et al (2010) analyzed few parameters that correlated to soft tissue aesthetics and used a technique that has not been used clinically for at least 10 years. For instance, why a mucoperiosteal flap should be opened when extracting a tooth?

Additionally, Caneva et al (2010) demonstrated in dogs that implant position in extraction sockets influenced the exposure of the implant. The classical conceptual publication by Saadoun et al (1999) described the three-dimensional implant position for aesthetic results and indicated the use of surgical guides and periodontal probes in order to obtain reference points at the surgery for optimal implant positioning. These two papers are important when analyzing the experimental study in dogs of Araújo et al (2005) that used 10 Straumann implants of 4.1mm. After 3 months of healing buccal bone loss was of 2.6mm and the mean lingual bone loss was of 0.2mm. This observation does not fit with the observation seen in humans by Sanz et al (2010).

In another study Calvo-Guirado et al (2010) performed a histological and histomorphometric evaluation of

![Figure 13 — Note soft tissue thickness and harmonious papillae](image)

![Figure 14 — Radiograph, one-year post-op](image)

**Table 1: Notable Influences on the Class I (Elian et al) Postextrsaction Alveolus**

- Implant design
- Implant surface
- Abutment connection
- Number of abutment disconnections
- Abutment design
- Three-dimensional implant position
- Material used to fill the void between the implant and buccal bone
- Immediate provisionalization
- Buccal bone thickness
- Use of flap or flapless surgery
- Patient’s soft tissue biotype
- Use of soft tissue augmentation
- Type of extraction technique
- The use of counterboring during implant site preparation.
immediate implant placement on the dog model with a new implant surface treatment and observed that the amount of buccal bone resorption was less pronounced than the resorption at the lingual aspect even in the control sites. How should a clinician interpret the result of these two dog studies? If a clinician wants to obtain buccal bone resorption they should use the implant used by Araújo et al. (2005), but if he/she would like to avoid buccal bone resorption, then they should consider using the implants used by Calvo-Guirado et al. (2010)?

Conclusion
The results of different studies should not be always extrapolated and taken as written in stone. A group of parameters evaluating osseointegration and soft tissue aesthetics should be used and evaluated using contralateral natural teeth in references.

The main question now in dentistry: Is it necessary to reinvent the wheel? Who Knows! We may need to come back to the prospective type of clinical case study design, which may be more realistic, to allow for better information and therefore this would be more similar to what we see in everyday clinical practice. Treating patients with lost teeth in the aesthetic region requires increased knowledge and in many instances a multifactorial approach.

References:
4. Canullo et al. (2010)