UELI GRUNDER

IMPLANTS IN THE ESTHETIC ZONE

A step-by-step treatment strategy

QUINTESSENCE PUBLISHING

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Ueli Grunder

Dr Ueli Grunder graduated in 1982 from the Dental Institute of the University of Zürich and received his doctorate degree (Dr med dent) in 1984. After working for two years in private practice, he completed a three-year Postgraduate Masters Degree program in Crown and Bridge, Partial Dentures and Materials Science under the tutelage of Professor P. Schärer at the University of Zürich, where he has taught dental implantology since 1987. Dr Grunder was accredited as a Reconstructive Dentistry Specialist (SSRD specialist status) in 1993, and has held a WBA Postgraduate Education Diploma in Oral Implantology from the Swiss Dental Association since 2011. He runs a private practice in Zollikon-Zürich, Switzerland, with Dr Gaberthüel from 1989 to 2014, and with Drs Schneider and Jung since 2014.

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Dr Grunder is Past-President of the Swiss Society of Oral Implantology (SGI) and the European Academy of Esthetic Dentistry (EAED). He also works as a reviewer for several dental journals.

for Barbara and Louis

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1 INTRODUCTION

1.1 WHY THIS BOOK?

While it has long been known that dental implants have offered dentistry wonderful treatment options,[1] and although both scientific evidence and clinical experience show that very high success rates can be achieved with dental implants, it is not a simple undertaking to achieve optimal esthetic outcomes when placing dental implants, even today. If the success or failure of implant therapy is considered from a purely functional point of view, then success is defined in terms of implant survival. According to this definition, it is relatively irrelevant whether there are one to two millimeters more or less of bone around the implant; however, if the goal is to achieve optimal esthetics, a one-millimeter loss of soft tissue may mean an esthetic compromise. Likewise, the local biological conditions may prove to be a limiting factor that makes it impossible to achieve optimal esthetic results. Therefore, ensuring good esthetics is still one of the greatest challenges in dental implant therapy.

Teeth have a very specific function in the context of the alveolar ridge and the surrounding soft tissue. At sites where no teeth develop, the alveolar ridge and periodontal soft tissue will not develop to normal dimensions. The teeth are thus the actual lead structures for hard and soft tissue development, and the presence of teeth is a condition necessary for a harmonious appearance and esthetic result. Loss of teeth results in a loss of the necessary structure to maintain the surrounding bone and soft tissue, and this inevitably leads to changes in the tissue, with corresponding changes in esthetics. For this reason, it is necessary to either prevent tissue loss or to perform tissue augmentation procedures to compensate for tissue loss when implants are used to treat tooth loss in the esthetic zone. The fact that the process of tooth extraction itself leads to tissue loss is aggravated by the reality that tooth extraction is most commonly performed due to infection, a pathology associated with additional tissue loss.

Dental implant surgery is a special challenge because both oral surgery and prosthodontic expertise are needed to achieve the desired goals of treatment. Moreover, each stage of treatment has impacts upon the subsequent stages. Such a complex, multistage treatment process can only be successful if possibilities and limitations are identified and incorporated into the treatment plan at each stage of treatment.

In implant therapy concepts, which were developed with the goal of achieving optimal esthetic results, undisputed factors that must be considered in every case have been identified over the course of time. However, there are various treatment approaches that lead to the same goal. The author does not claim that the approaches described in this book are the only ones possible. However, most of them have proven to be effective over many years of clinical experience. For each procedure described, details to consider when using other treatment modalities are also mentioned. In the following chapters, the goal is not only to provide general guidelines but also to discuss numerous details. This step-by-step approach is reflected in the subtitle of the book. In order to achieve truly optimal results and avoid unpleasant surprises, it is crucial to follow a good general strategy, while taking countless small details into account.

I hope this book will be a useful resource that helps to avoid failures and achieve successes that delight not only the patient but also the dentist.

1.2 CITING OF REFERENCES

A list of references is usually provided at the end of a textbook or scientific article. The literature listed in the reference section serves to give readers the opportunity to deepen their knowledge of the subject matter of the article or book by reading the scientific literature. Literature references are also an important way to give credit to the experts who first described something or made an important scientific contribution. However, literature references are rarely selected in an objective manner. In addition to citing important research results, the articles cited in the literature list are very often mainly those that provide scientific evidence in support of the concepts the author is putting forward. As you would expect, supporting evidence for any concept you can imagine can be found in the literature. This highly subjective method of literature selection may suggest to the reader that the text published by an author is not the author's own personal opinion but a consensus that has been arrived at with other authors/colleagues who have drawn similar conclusions. When citing the literature, authors often deliberately fail to mention articles with contradictory results or conclusions, even if such articles are of a high scientific standard or describe valid evidence.

Different types of studies are assigned different levels when it comes to the value of the scientific evidence presented. A case report, for example, is assigned a much lower level than a randomized double-blind study. However, those in clinical practice may not quite agree. Case studies, which describe nothing more than the clinical experience of the author – who is usually a skilled clinician – are often extremely valuable.[2] Conversely, many articles that are assigned high levels in terms of their evidence are indeed subject to criticism. Double-blind studies, for example, are designed to eliminate selection bias (case selection), yet double-blinding can be quite problematic once one starts performing studies in patients. For the experienced clinician, case selection is probably the most important factor when deciding which method is appropriate or inappropriate for successful treatment. If case selection is not carried out – in spite of the fact that the experienced clinician usually already knows that a certain method will most likely yield better results in a specific case, or that a certain method would be more beneficial in another case – it can only be regarded as ethically questionable when studies that deliberately eliminate patient selection are still performed. A lack of experience is no excuse when it comes to the selection of the best method for the individual patient case.

On a deeper reading of the dental literature, it is amazing to discover how many scientific papers that supposedly have a high level of scientific evidence have been accepted by an ethics committee. Performing such randomized double-blind studies on patients is only justifiable when comparing two methods or materials in cases where even the experienced clinician must admit that both have the same odds of success in all patients (independent of patient selection), and that the study is only intended to identify any potential differences between the two.

Literature reviews (systematic reviews) have been published in steadily increasing numbers in recent years. This is a method of filtering the literature on a particular topic using inclusion and exclusion criteria so that in the end only a few appropriate articles remain. In theory, it makes sense that only high-quality scientific work is included in the study. In practice, however, it is possible to greatly influence the outcome through the use of inclusion and exclusion criteria. The initial mass of available studies is further reduced

based on the contents of the summary (abstract) alone and, in the end, only a few studies remain in the final selection of articles that are actually read and discussed in detail. Finally, systematic reviews are often written by less experienced dentists (for continuing education and training purposes).[3,4]

Besides the issues related to the definition of inclusion and exclusion criteria and the resulting influence on the results, another point of criticism is that a study can rarely be fully appreciated based on the abstract. As there are hardly any studies that are not funded by the industry, particularly in implantology,[5,6] the results often have to be published in ways that reflect the interests of the industry. Consequently, one will often not find any really interesting or relevant results in the abstracts. Instead, they often contain conclusions that prove to be questionable on closer scrutiny and when one performs an in-depth analysis of the text, results, and numbers. Another factor to consider is that associates in clinical practice rarely read systematic reviews in detail. These articles often serve to help find appropriate secondary literature when writing articles.

Meta-analyses are somewhat more useful. Although the inclusion and exclusion criteria have a decisive potential for bias, meta-analyses attempt to aggregate and scientifically analyze very large volumes of data from various studies. Unfortunately, meta-analyses on the really interesting research problems are rarely available because high-quality studies on such topics are lacking.

Due to these very critical but probably realistic reflections regarding the issues relating to the selection of references cited in the literature (including lectures, articles, or textbooks), this book will dispense with citing countless literature references. Instead, only a small list of relevant scientific literature is provided at the end of each chapter. The references are, of course, selected according to the author's subjective opinion. In many cases, the aim of inclusion was to give credit to authors who first published very interesting work, or to those who succeeded in publishing very useful summaries for their colleagues in clinical practice. The author recognizes this selection bias and makes no claim to objectivity. The number of authors per article has steadily increased in the dental literature in recent years.[7] Against this rather unscientific trend, in this book, if there are more than five authors of a given article, only the name of the first author plus "et al" is included in the citation. The rationale behind this is that, unfortunately, most of the countless additional authors often have nothing to do with the actual research. Many researchers mention colleagues as coauthors in order for those colleagues to obtain as many published articles on their résumés as possible.

1.3 INSTRUMENTS USED

The author deliberately avoids giving a detailed description of the instruments used in the procedures described in this book. In the cases presented here, surgery was usually performed using conventional instruments. Microsurgical instruments were rarely used because, in the author's opinion, they have no visible benefits. Although we dentists tend to have preferences for certain instruments and often talk about them, it makes little sense to give general advice on instrument selection. In clinical practice, dentists must find out for themselves which scalpel or needle holder works best for them. However, the goal is always the same: To select an instrument that allows for fast yet very precise work. It is not necessarily a good idea to use extremely fine instruments that slow down the workflow if one can

achieve exactly the same precision with conventional instruments. Furthermore, experience has shown that it is usually not advantageous to perform the surgical procedures described here under a microscope in clinical practice because the field of view of a microscope is too small for these applications. The use of a loupe (4X to 6X magnification) has proven to be an ideal solution. Due to the fact that the dentist can observe the patient's movements while wearing the loupe, unnecessary workflow interruptions that increase the working time are avoided.

1.4 MATERIALS USED

The proprietary names of the materials used are not mentioned throughout the book. Especially in the case of dental implants, there is a wide range of products that produce optimal results.

In the early years, the choice of implant had historical significance, but nowadays, implant selection is driven primarily by the available suprastructure options. Therefore, the implant system should be selected primarily by the prosthodontic dentist and not the surgeon. Today, the biggest differences between the various implant systems relate to the connection between the implant and the suprastructure, and to the available materials and parts for the implant–abutment connection. Titanium implants from the following manufacturers were used in the cases presented in this book: Biomet 3i, Nobel Biocare, and Thommen Medical.

The non-resorbable membrane most commonly used for ridge augmentation procedures was the Gore-Tex expanded polytetrafluoroethylene (ePTFE) membrane, which is no longer available on the market. In more recent cases, Cytoplast (Osteogenics), a dense polytetrafluoroethylene (PTFE) membrane, was used as an alternative, following exactly the same principle as for the ePTFE membrane.

OsseoGuard (Biomet 3i) is the cross-linked collagen membrane used today. Bio-Gide (Geistlich Pharma) was the most commonly used pure collagen membrane. Bio-Oss (Geistlich Pharma) was often used as the bone filler material for alveolar ridge augmentation; this bovine xenograft material was generally employed as a ready-to-use mixture in combination with Bio-Oss Collagen (Geistlich Pharma), a porcine collagen product. Various other collagen membranes and bovine xenograft products were occasionally used.

Regarding suture materials, Gore-Tex 50, 60, and 70 monofilament sutures manufactured from PTFE were most commonly used. In addition, Seralene 7-0 (American Dental System) monofilament polyvinylidene fluoride sutures were used for the adaptation of wound edges. As regards postoperative medications, our patients were given mefenamic acid *[1] (Ponstan, Pfizer) for pain, and chlorhexidine rinse (Plak-Out, KerrHawe) to control postoperative inflammation. All ridge augmentation patients received antibiotic prophylaxis with Clamoxyl (GlaxoSmithKline) or, in more recent cases, other amoxicillin products.

Regarding innovations, the same rule applies to materials as to surgical techniques, which is that it only makes sense to switch to new products (which are constantly being introduced onto the market)

*1 Drug approved in many countries around the world, but not in Germany.

if they really make it possible to accomplish something that was not possible with the products used so far. Bearing this in mind, most new products are of no consequence because they usually only offer that which is already on the market in another form, and their so-called advantages over existing products, according to the claims of the manufacturers, do not pan out in clinical practice.

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2 ESTHETICS

2.1 GENERAL

The term "esthetic" is often overused. In dentistry, countless books and numerous guidelines have been published on this topic.

In the context of implant therapy, it soon becomes clear that the key to optimal esthetics is a harmonious soft tissue profile (assuming an otherwise healthy clinical situation). Harmony is that which is beautiful and esthetically pleasing to the eye of the beholder. It is not possible to achieve the absolutely essential harmony in tooth shape without a harmonious soft tissue profile. Tissue quality and clinical crown quality are also critical factors because they are ultimately visible. Therefore, the main focus of the dentist's work is to establish soft tissue harmony. If this condition is not met, it will be impossible for the dental technician to fabricate a crown that fits in harmoniously with the surrounding gums and teeth. A tissue deficit can be very difficult or impossible to correct after the completion of treatment, especially in the case of implant therapy. If certain treatment procedures are not performed in a meaningful sequence, it is difficult to achieve the desired result predictably or with high probability.

As described in the introduction section, the tissue deficits encountered in dental implantology generally occur as a result of tooth loss. Therefore, the restoration of bone and soft tissue volume is a key element of dental implant therapy (Fig 2.1).

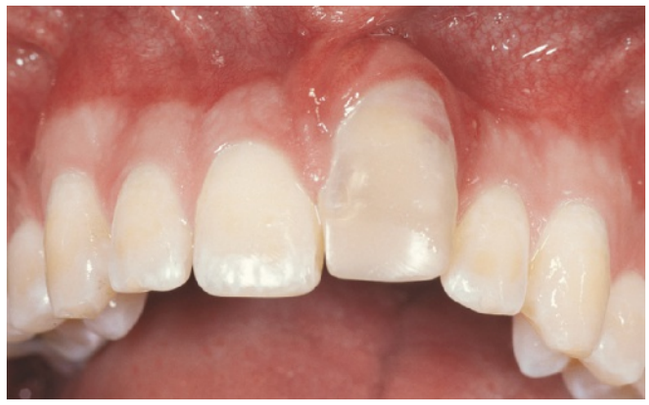
2.2.1 What does "esthetic" mean?

The term "esthetic," as used in dentistry, means nothing more than "inspired by nature," provided that nature has created something that suits the person in question. Only that which suits the patient and his or her individual appearance and character is esthetic and harmonious. By this definition, a tooth replacement for a patient who smokes 80 cigarettes a day must be designed differently from one for a patient with beautiful white teeth without any caries. A dental prosthesis that reflects the character and habits of an older smoker can by all means be viewed as an optimal esthetic result (Fig 2.2).

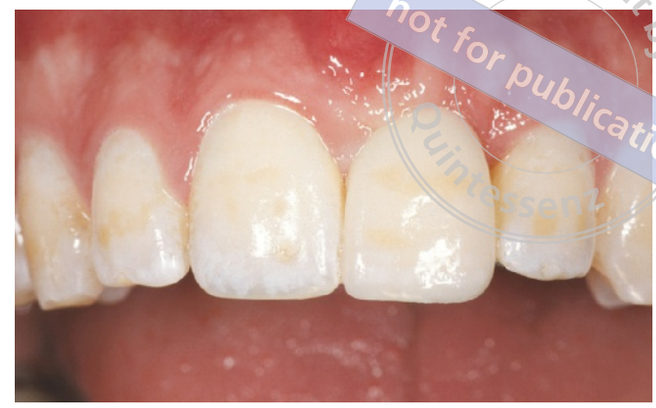
When inserted, the tooth replacement should fit in harmoniously with the natural teeth of the remaining dentition. It is usually harder to achieve this goal when replacing a single tooth than multiple teeth because of the direct comparison with the immediately adjacent natural teeth (Fig 2.3).

If there is a large edentulous space, a harmonious result can still be achieved, for example, if extensive papillae loss is present but is symmetrically distributed on both sides (Fig 2.4).

Fig 2.1

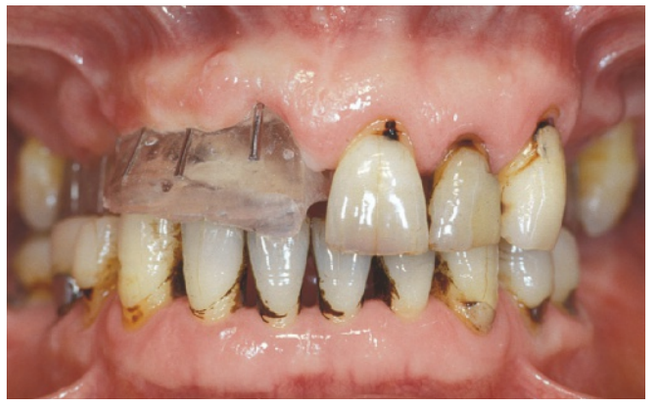


2.1a Irregular gingival margin before extraction of tooth 21.

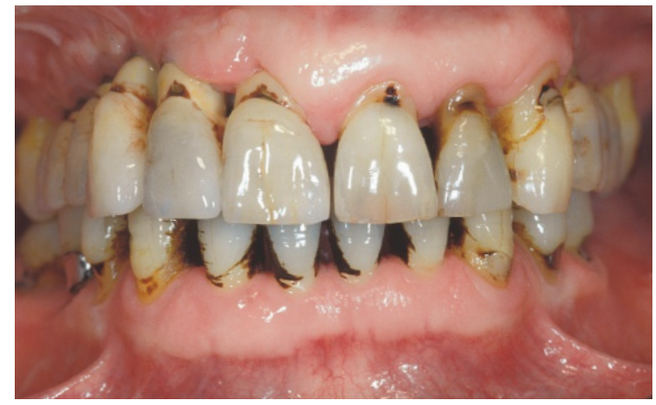


2.1b Good final result thanks to gingival correction.

Fig 2.2

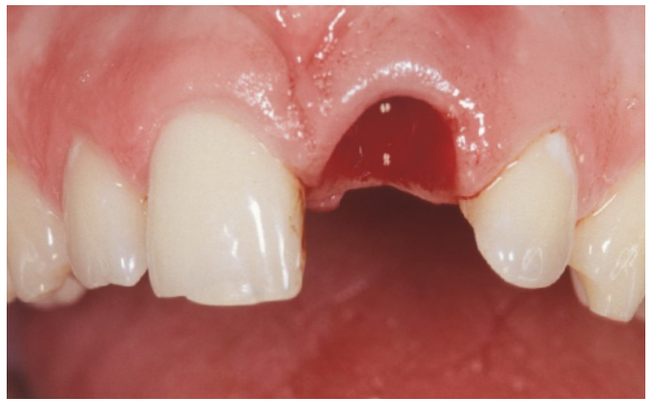


2.2a Missing teeth in the maxillary right quadrant of a heavy smoker.

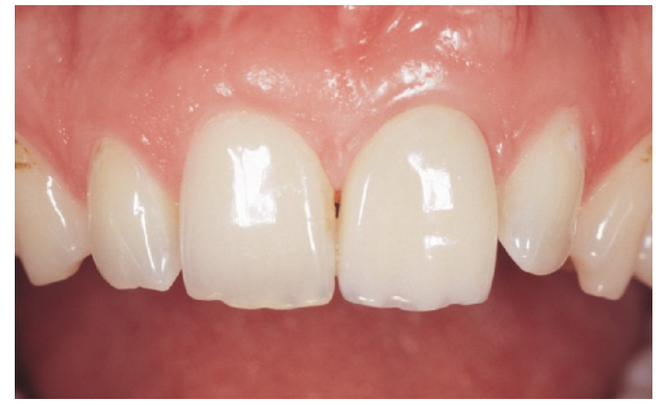


2.2b Nature-inspired implant-supported bridge.

Fig 2.3

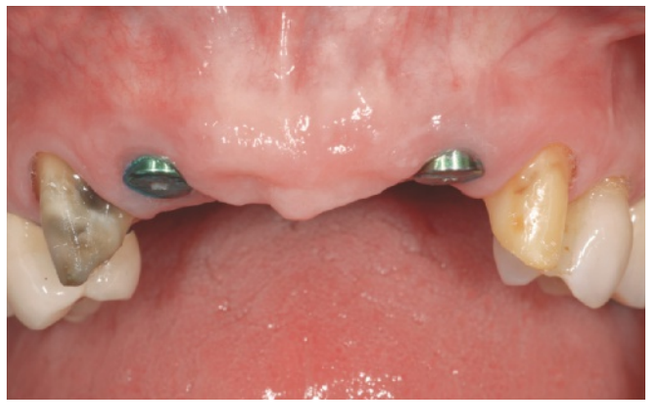


2.3a Tooth 21 has to be extracted.

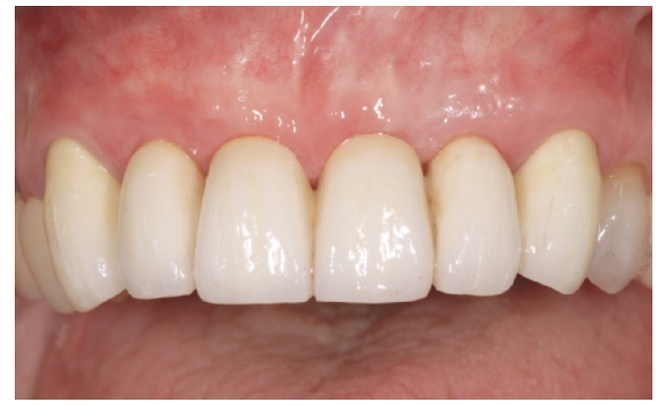


2.3b Implant-supported crown 21 matches natural crown 11.

Fig 2.4



2.4a Large edentulous space after ridge augmentation and placement of two implants.



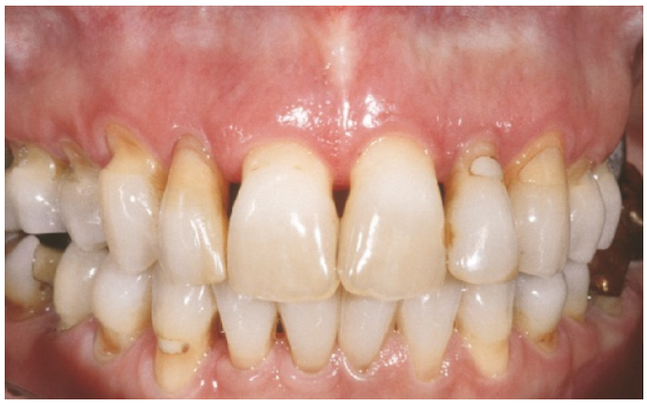
2.4b Harmonious final result although papillae are hardly present.

It becomes clear relatively quickly that dental treatments have their limits, especially from the esthetic perspective. Tissue around natural teeth that is lost, for example, due to attachment loss (which often occurs as a complication of inflammatory periodontal disease) cannot be regenerated in most cases. In some cases, this may be accepted as an individual characteristic of the patient. On the other hand, many patients with long teeth and missing papillae, which appear as "black triangles," do not find this attractive. However (as was already mentioned above but is often forgotten in clinical practice), not all problems can be treated, and not all patient wishes fulfilled or, if they can, then only by means that might not meet the patient's a priori approval.

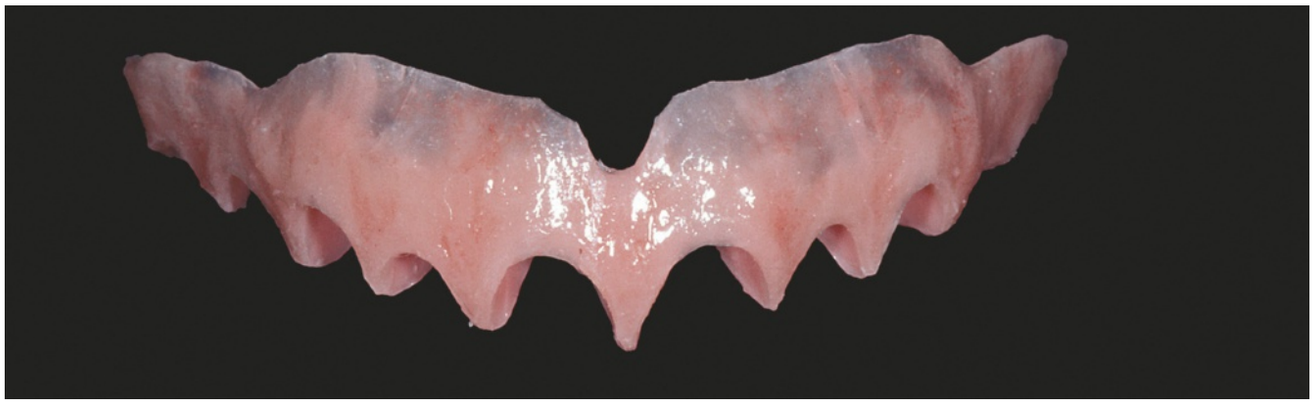
Periodontal attachment loss is a classic example, where the loss of attachment results in the appearance of long clinical crowns and, in some cases, the missing papillae. A removable gingival mask can satisfy the desire of some patients for optimal esthetics in these cases. However, the patient must be willing to accept the disadvantage that the restoration will have a removable part (Fig 2.5).

Although the esthetic appearance of a restoration is not judged by objective criteria alone because patient preferences and perceptions of esthetics vary, there are certain esthetic guidelines that have to be followed that imitate that which nature produces when it creates a harmonious dental appearance. Schärer et al[1] published an esthetic checklist for fixed prostheses in 1980. Although the original version has frequently been copied and modified since then, it is still valid today (Fig 2.6). These esthetic guidelines for restorative dentistry provide rules for ensuring that the soft tissue and clinical crowns are in harmony with the restoration. Without going into detail, it is sufficient to say that these criteria are well known. Even in patients with unsightly presenting conditions, a very harmonious final result can be achieved by following these guidelines. With this approach, it quickly becomes evident that creating a harmonious soft tissue profile ("pink esthetics") is the primary key to success, followed by the restoration with harmonious tooth shape.

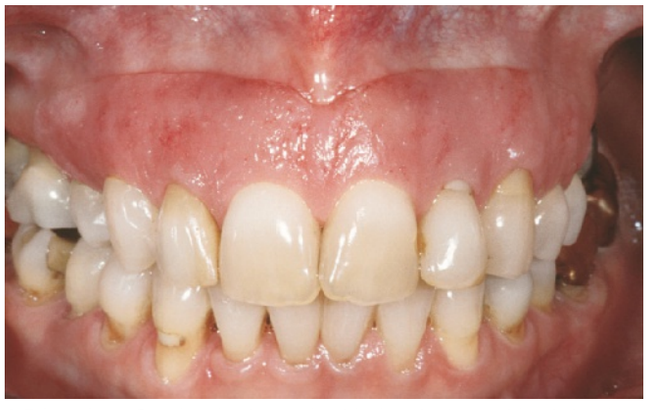
Fig 2.5

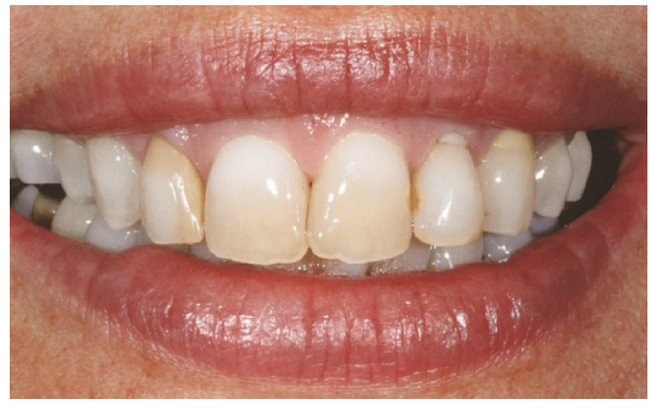


2.5a and b Status after periodontal therapy.



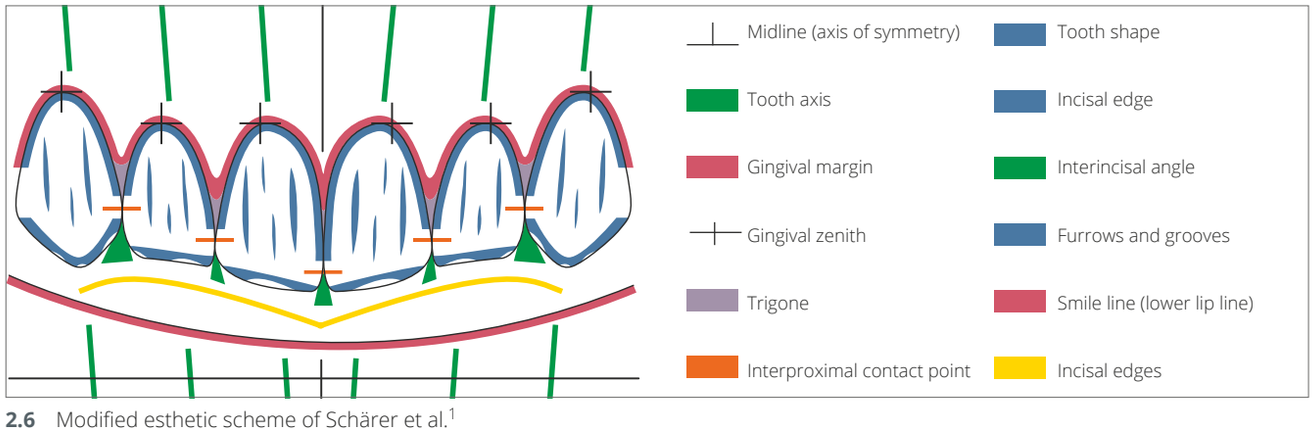
2.5c Flexible, removable gingival mask.





2.5d and e Good esthetic result with the gingival epithesis in place.

Fig 2.6



2.6 Modified esthetic scheme of Schärer et al.[1]

2.2 LONG-TERM RESULTS

The true success or failure of a treatment can only be determined after several years. From the patient's perspective, the long-term results are just as important as the immediate results achieved at the end of active treatment. An optimal esthetic outcome should remain intact for many years.

In the early years of implant therapy, knowledge about the requirements needed for primary success was lacking. A lot about the rate of osseointegration of dental implants was already known in the 1980s. Information on long-term survival rates and risk factors for implant failure was available. In contrast, no real data on the esthetic aspects of implant dentistry was available until the late 1980s to early 1990s. There was a lot of luck involved in many cases that are classified as a success after more than 25 years of follow-up (Fig 2.7). Much of the knowledge and experience that we have today was lacking during the period of active treatment back then.

As always in life, learning from failure is the fastest way to learn, assuming that a critical analysis of the results takes place. Over time, it became clear that non-gentle tooth extraction could result in soft tissue loss. Experience showed which types of incisions should not be used, what consequences improper implant placement could have, and which tissue augmentation technique did not produce the desired results. With time, it also became evident which materials failed to achieve the desired results, and what could go wrong when designing and manufacturing the suprastructure, in terms of technique as well as choice of materials.

It is also important to remember that changes occur in the patient's mouth over the course of time that are not necessarily pathological in nature. Two examples are the change in tooth color, and the natural soft tissue recession that occurs even around healthy teeth (Fig 2.8). Nowadays, these predictable changes can be taken into account to a certain degree.

2.3 SUMMARY

If the dentist pursues the goal of creating dental restorations inspired by nature, then a pleasing esthetic outcome will usually be achieved. Ultimately, the widely published guidelines for optimal dental esthetics are merely the result of careful smile analysis using images of healthy natural teeth that we subjectively like or consider to be attractive. However, conditions vary from one individual to another. Therefore, these idealized notions must be adapted to the individual situation so as to produce an image that suits the patient – in other words, an optimal esthetic result.

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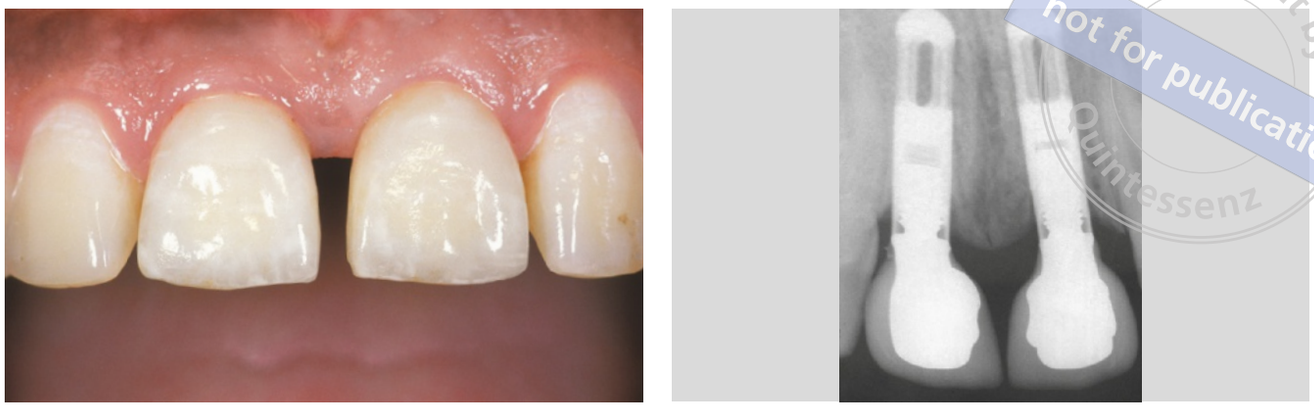
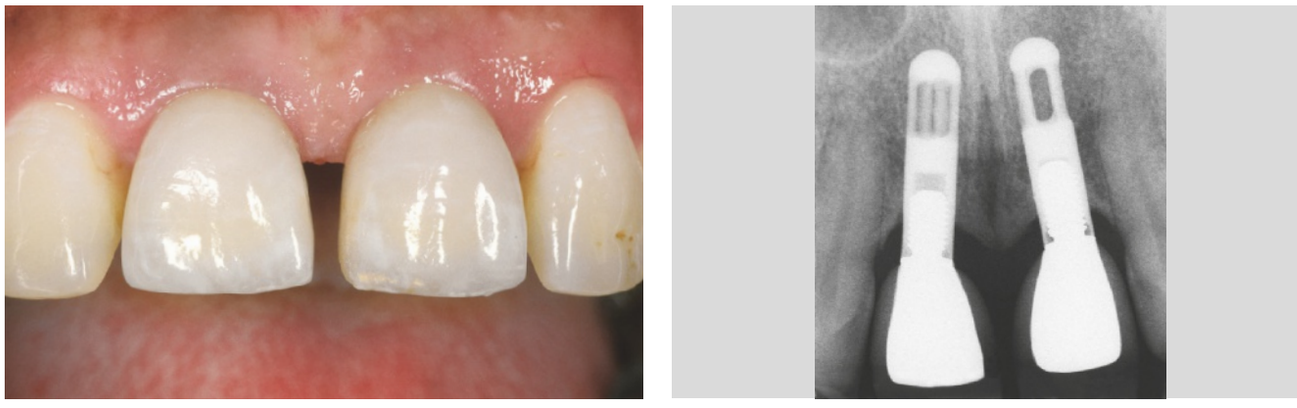
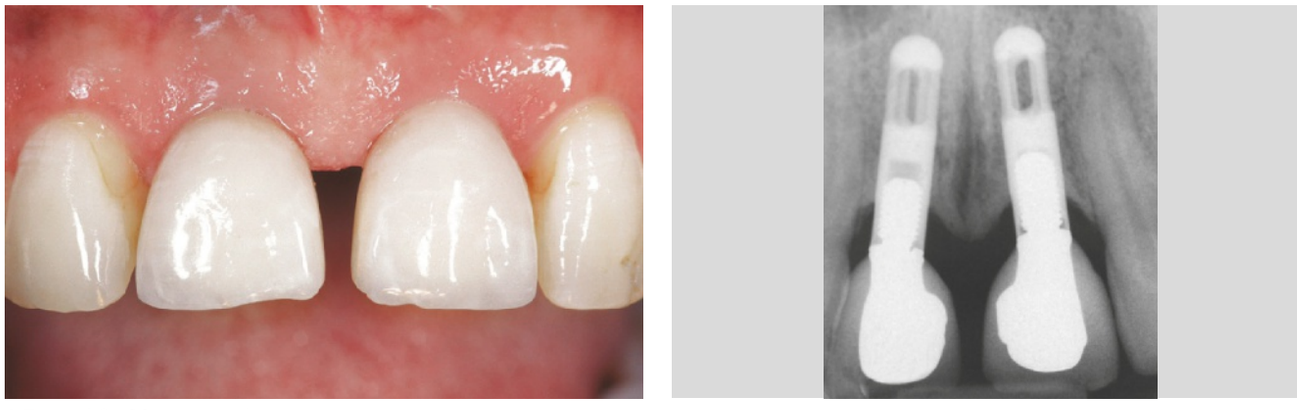


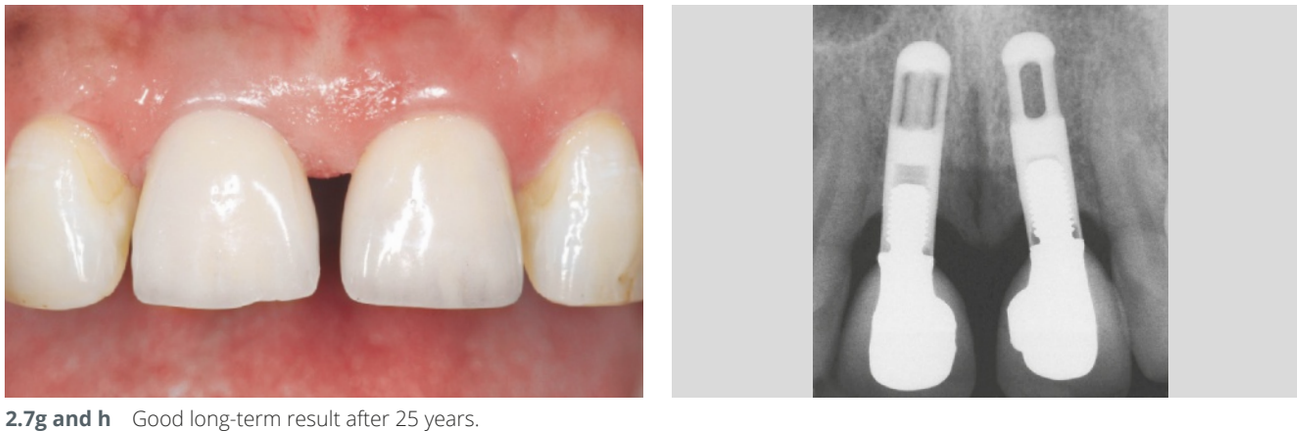
2.7a and b Implant-supported restoration of the maxillary central incisors completed in 1987.



2.7c and d 10-year result.

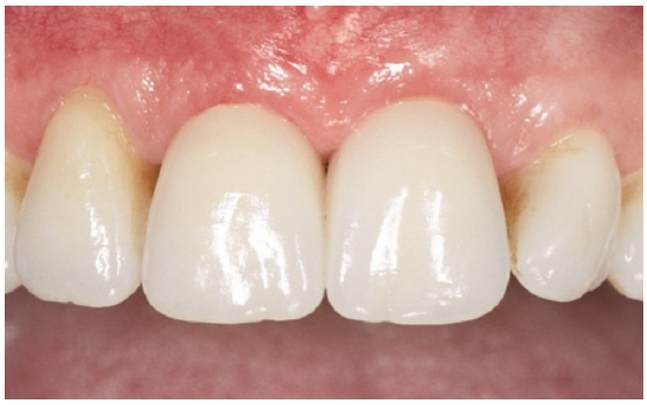


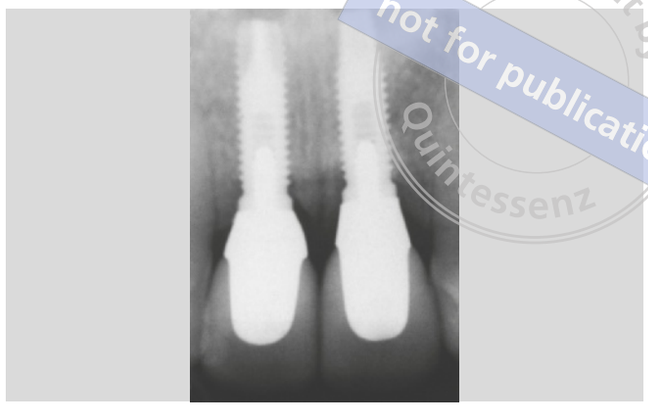
2.7e and f 20-year result.



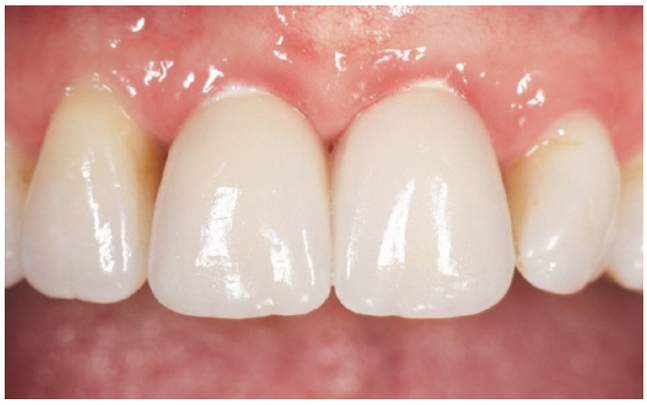
2.7g and h Good long-term result after 25 years.

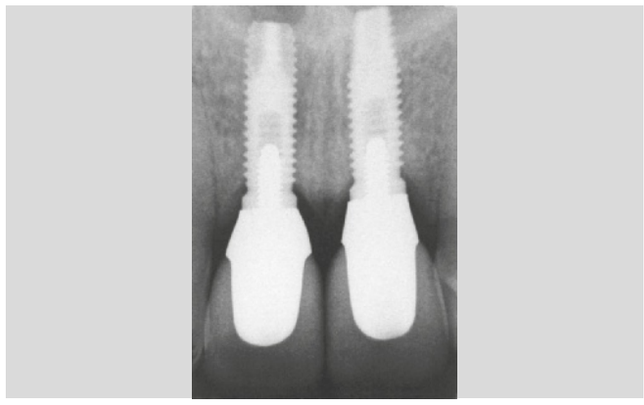
Fig 2.8



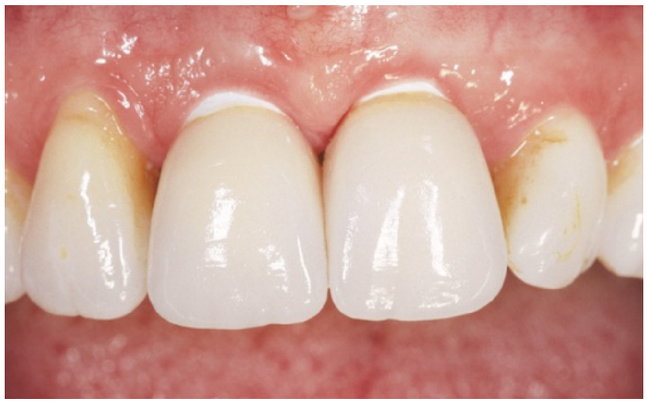


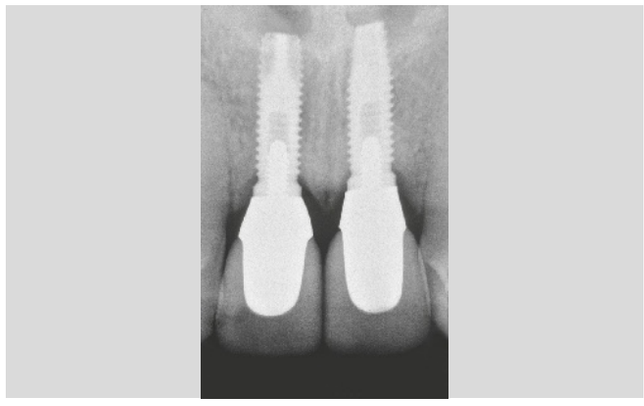
2.8a and b Implant-supported restoration of the maxillary central incisors completed in 1995.



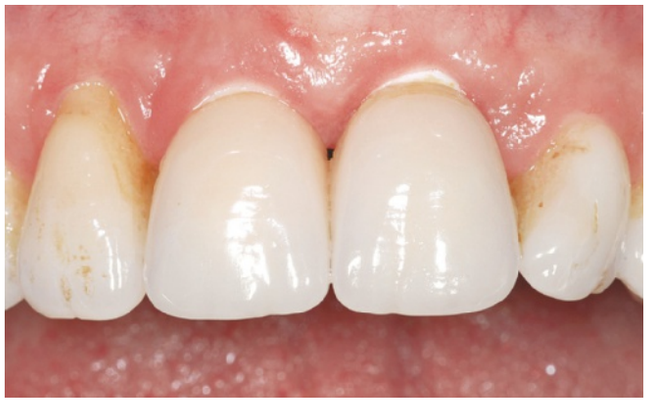


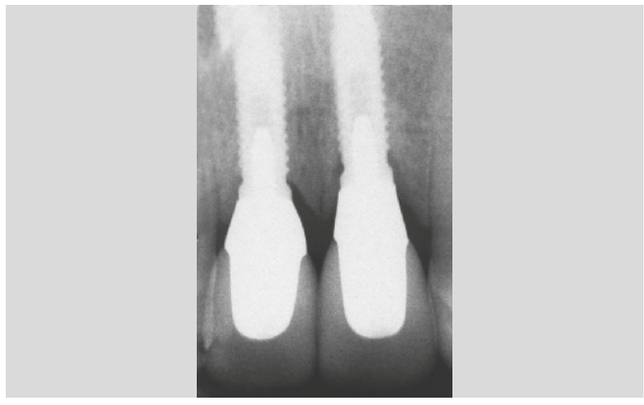
2.8c and d Tissue loss around the implants and natural teeth after 5 years.





2.8e and f 10-year result.





2.8g and h 15-year result.

3 POSSIBLE FAILURES

Führhauser et al[1] were the first to publish a scoring system for "pink esthetics." If the presenting clinical conditions are extremely adverse, failure can be unavoidable in some cases. When replacing teeth with implant-supported reconstructions, an important goal is to achieve a harmonious soft tissue profile with beautiful pink esthetics.

3.1 EXCESSIVELY LONG CLINICAL CROWN

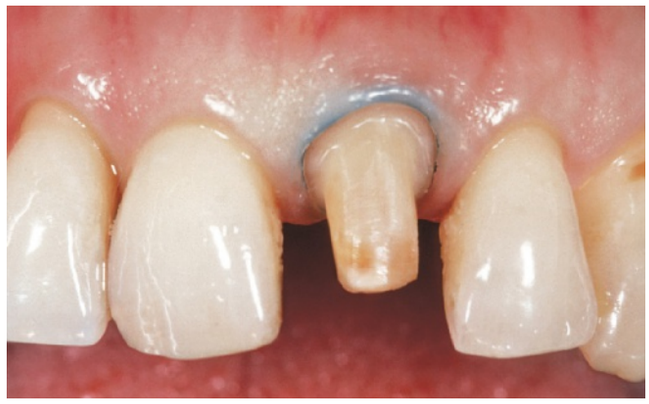
The first possible complication that comes to mind is excessive clinical crown length. Crown length is defined as the distance from the incisal edge (smile line) to the most concave part of the gingival margin, which defines the apical end of the clinical crown. If a certain amount of soft tissue deficit is present in the apicocoronal direction, the clinical crown will appear too long, if the position of the incisal edge is correct. The fact that this does not necessarily cause excessive disharmony in every case is demonstrated by the case of a patient who needed to have a natural tooth crowned (Fig 3.1). As can be seen in the photographs, although the entire maxillary anterior segment was not ideal, the overall appearance of the anterior teeth is not inharmonious.

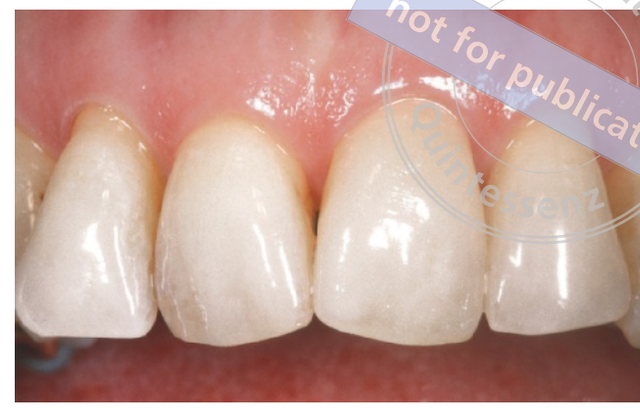
Excessively long clinical crown length is a common failure of dental implant therapy. In most cases, the surgical error leading to this compromise can be readily identified: improper implant positioning or inadequate treatment planning with or without sufficient soft tissue augmentation (Fig 3.2).

3.2 SCARRING

If scarring suddenly appears after treatment in an area where there was no scar tissue before treatment, then it can be assumed that a surgical error was made. Certain surgical techniques can leave scars in visible places – not in every case, but often (Fig 3.3). Needless to say, these surgical procedures must be modified accordingly when used in the esthetic zone. Conversely, visible scars are sometimes already present before surgery. Appropriate measures to eliminate these scars (if possible) should be incorporated into the treatment plan for such patients.

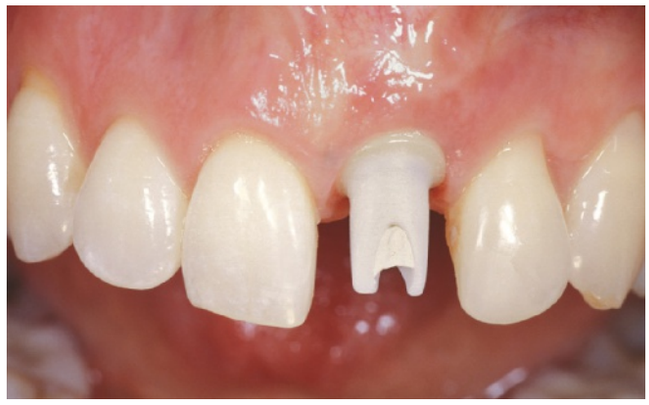
Fig 3.1

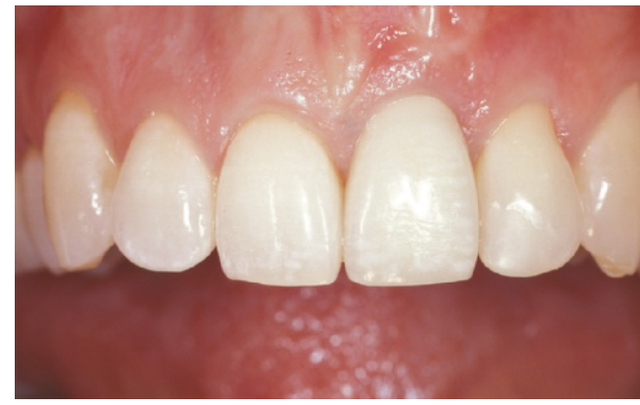




3.1a and b An irregular gingival margin resulted in excessively long clinical crown length of tooth 21.

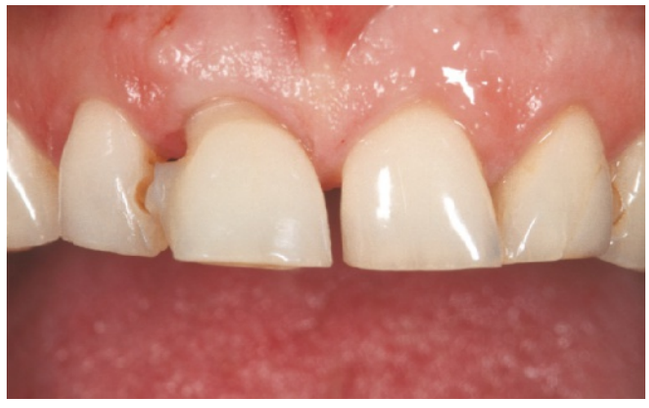
Fig 3.2



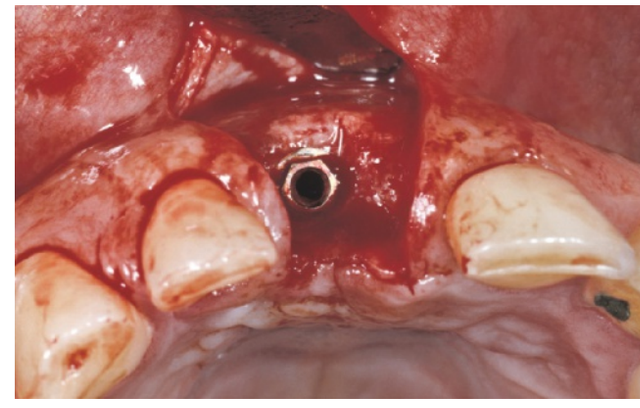


3.2a and b Failure occurred due to a vertical soft tissue deficit around the implant crown.

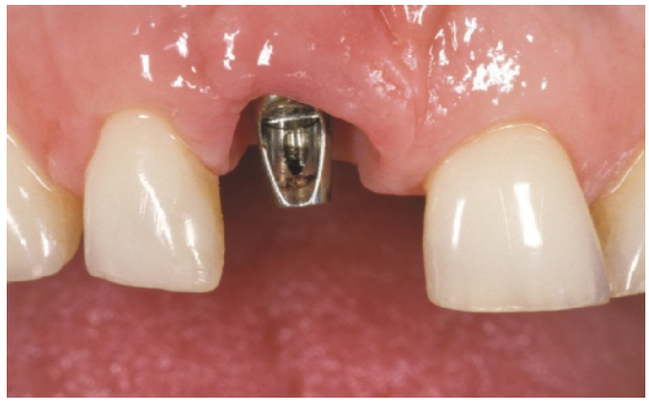
Fig 3.3

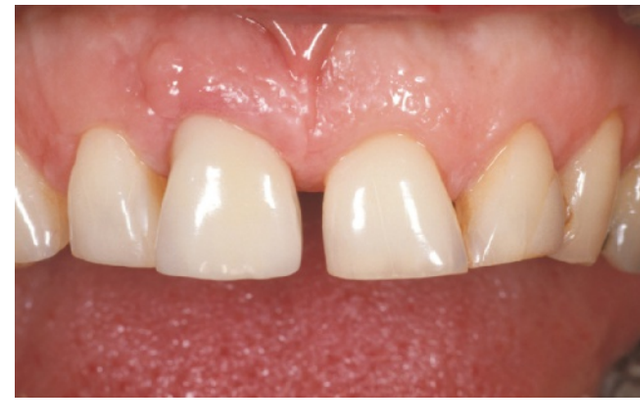


3.3a The gingival margin was relatively harmonious before the extraction of tooth 11.



3.3b Unfavorable incision placement when inserting the implant.





3.3c and d Failure due to a vertical soft tissue defect and visible scarring around the implant crown.

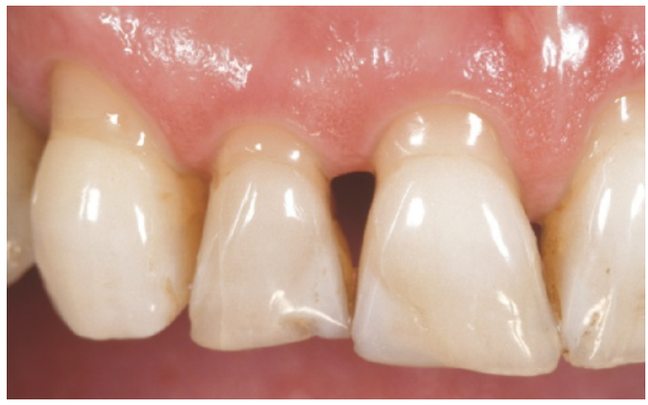
3.3 ABSENCE OF PAPILLAE

The loss of attachment between two natural teeth (which usually occurs due to inflammation) results in the loss of soft tissue support and of perfect papillae esthetics. As the predictable regeneration of the papilla between two adjacent teeth is hardly possible by therapeutic means, prosthetic correction is just about the only option. This is done by reshaping the two adjacent teeth so as to move the contact point between them to a more apical position and thus close the open embrasure or "black triangle." The result, however, is an altered tooth shape that no longer fits in harmoniously with its surroundings. The practice of changing a triangular tooth shape into a square tooth shape to compensate for the absence of a papilla is a classic example. The square tooth shape is the trade-off for the decreased size of the black triangle (Fig 3.4).

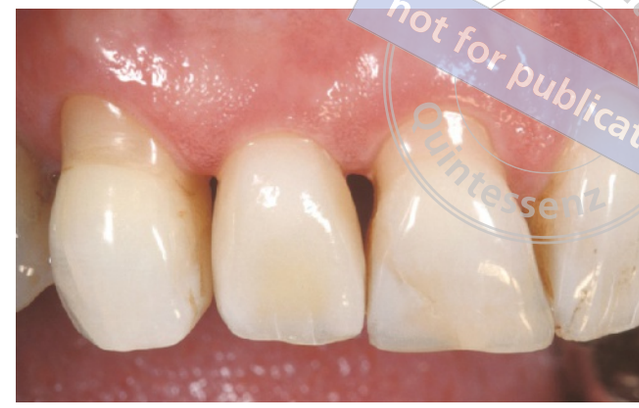
Similar rules apply to implants. In some cases, soft tissue loss in the interproximal region may make it impossible to restore the papillae at the implant site. In other cases, interproximal soft tissue is present initially but destroyed in the course of surgery, resulting in an iatrogenic compromise (Fig 3.5). The data is clear regarding the factors that must be considered in dental implant surgery to preserve existing papillae or restore missing papillae to some degree. A papilla missing from an otherwise harmonious soft tissue profile in which all other papillae are present can have a very disruptive effect. Therefore, this is an important factor that must be given due consideration.

Experience has shown that, from a biological perspective, a papilla between an implant and an adjacent tooth must be treated differently from a papilla between two adjacent implants. Preservation or reconstruction of the papilla between two adjacent implants is possible but extremely difficult, and a poor surgical technique will result in immediate failure (Fig 3.6).

Fig 3.4

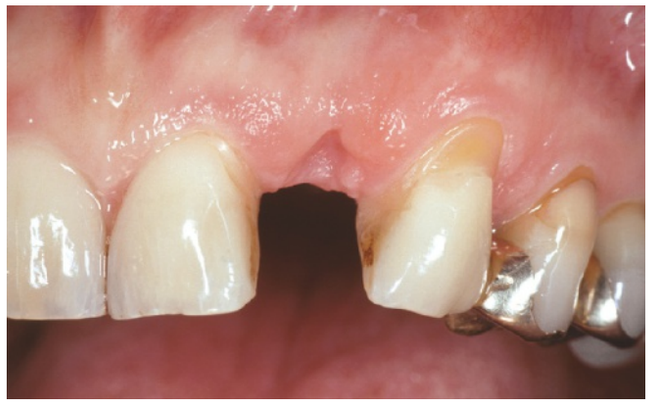


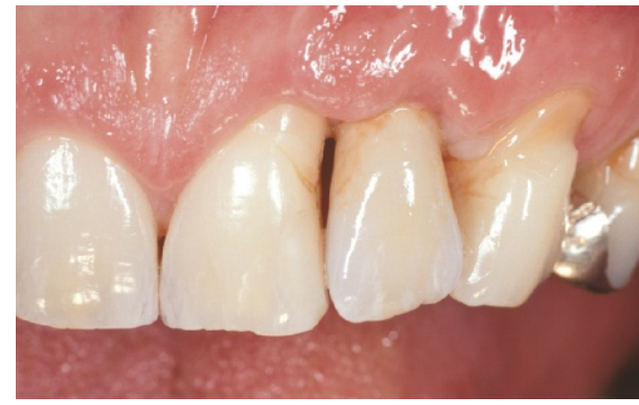
3.4a Missing papilla between the central and lateral incisor.



3.4b Partial interdental space closure achieved at the expense of ideal crown shape (tooth 12).

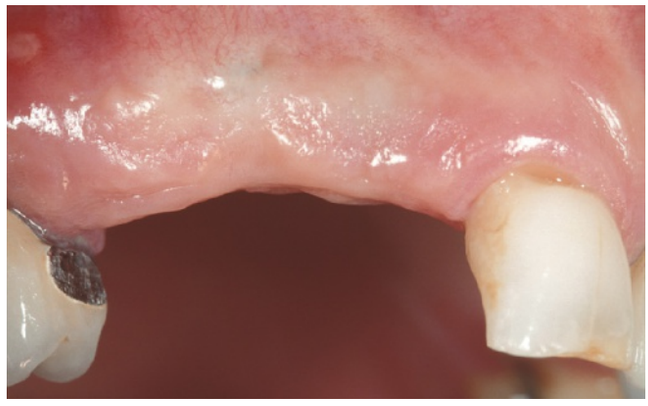
Fig 3.5



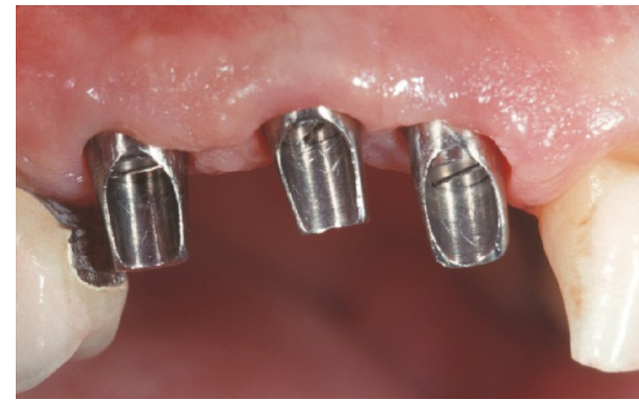


3.5a and b Treatment failure due to soft tissue deficiencies, especially in the papillary region.

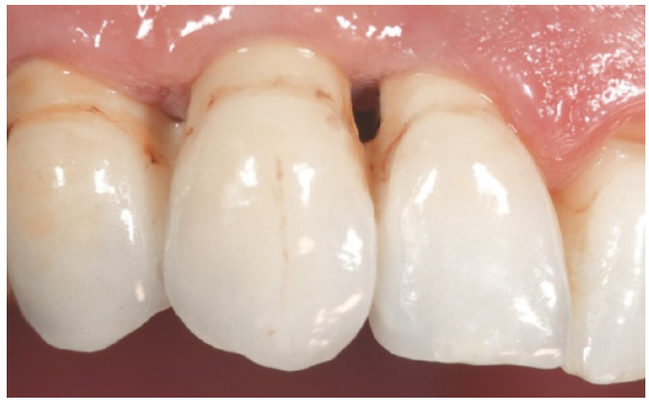
Fig 3.6

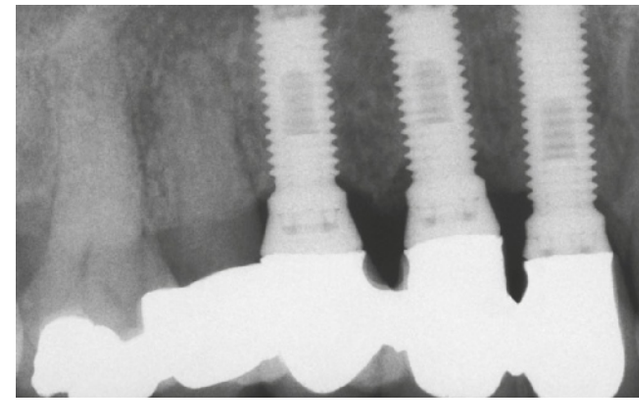


3.6a Preoperative view of a site with three missing teeth.



3.6b Three implants placed very close together.





3.6c and d Treatment failure due to the absence of papillae between the implant crowns.

3.4 BUCCAL TISSUE VOLUME DEFICIENCY

A tissue volume deficiency on the buccal side results in the development of a concavity relative to the adjacent tissue levels. The presence of such a concavity always means one thing: shadowing! Shadowing results in dark discoloration and, in many cases, esthetic compromise. This is already known from traditional crown and bridge work: If, at the pontic site, there is adequate tissue in the vertical dimension but not on the buccal side, the deficiency cannot be corrected by prosthetic means, and the dark discoloration and shadowing described above occur (Fig 3.7).

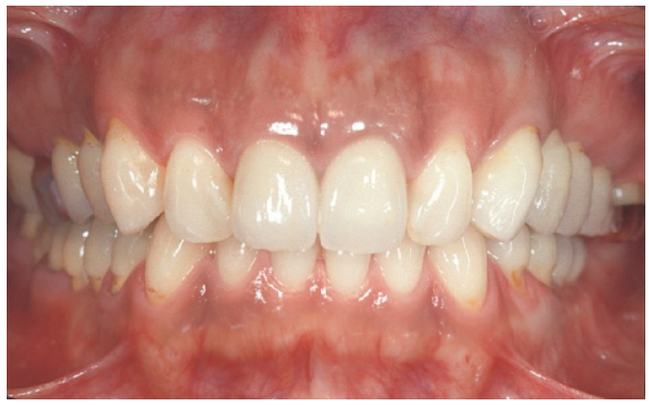
Obviously, the same phenomenon must be taken into account in implant therapy. Again, the presence of adequate tissue in the vertical dimension alone will not suffice to prevent shadowing. Sufficient tissue must also be present on the buccal side, and the tissue volume must harmonize with that of the adjacent teeth. Otherwise, the result may look great from the intraoral frontal view, but from the extraoral smile view, a patient with a high smile line exposes the volume deficit and reveals the esthetic compromise (Fig 3.8). The implications for practice are that measures must be undertaken to prevent buccal tissue resorption, or an appropriate surgical tissue augmentation procedure must be performed.

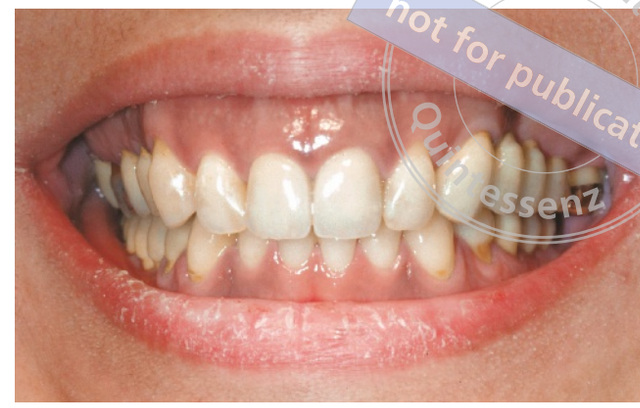
3.5 RESTORATIVE MATERIALS THAT CAUSE SOFT TISSUE DISCOLORATION

In traditional crown and bridge work, it is a well-known fact that dark tooth roots and metal frameworks supporting crowns can cause soft tissue discoloration. These mostly dark areas have a very negative esthetic effect. In conventional prosthodontics we have learnt that the effects of discolored roots, which are intensified by the crown, can be significantly reduced simply by replacing the restoration with a metal-free reconstruction (Fig 3.9).

The same applies in implant therapy. In patients with certain soft tissue types, the insertion of gray metallic structures in the submucosa can result in unsightly discoloration (Fig 3.10). Again, there are ways and means available to replace these metal structures with all-ceramic restorations in order to minimize the problem.

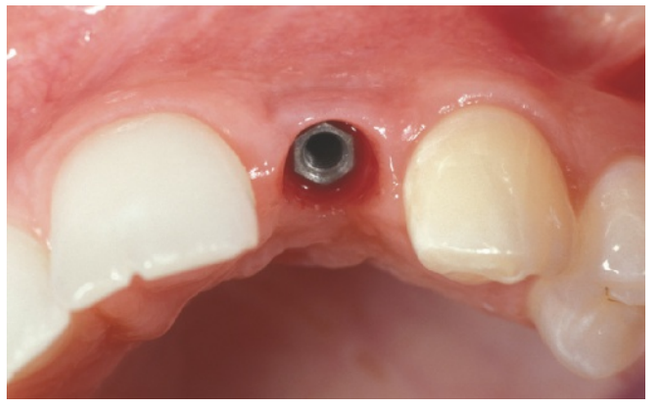
Fig 3.7

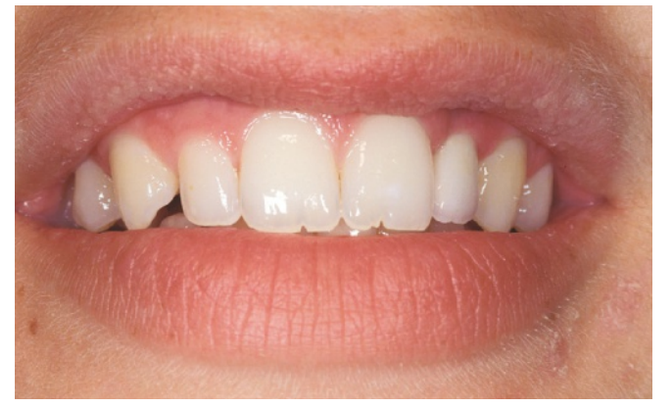




3.7a and b Shadowing on this bridge restoration in the left maxilla due to a buccal concavity of the alveolar ridge.

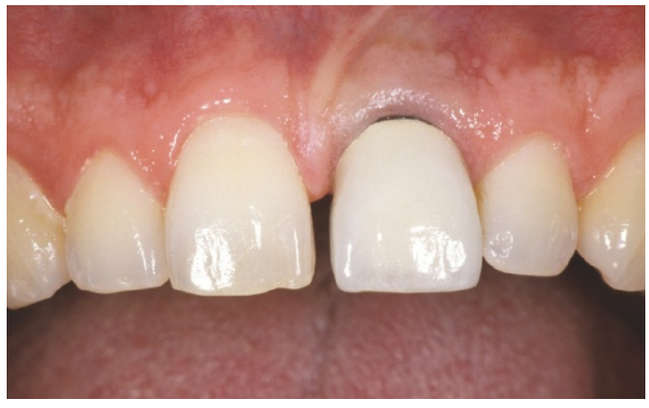
Fig 3.8



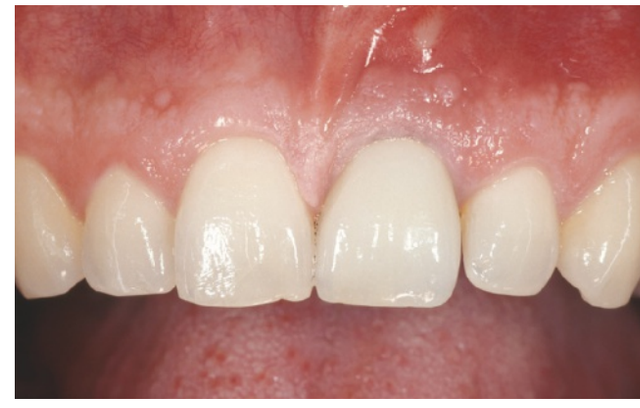


3.8a and b Failure due to shadowing resulting from a buccal soft tissue deficit around implant crown 22.

Fig 3.9

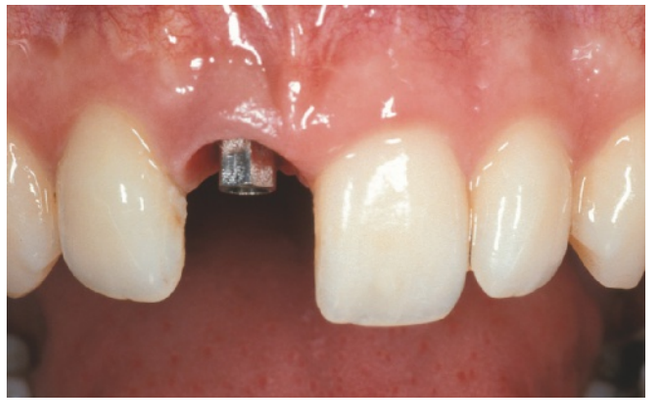


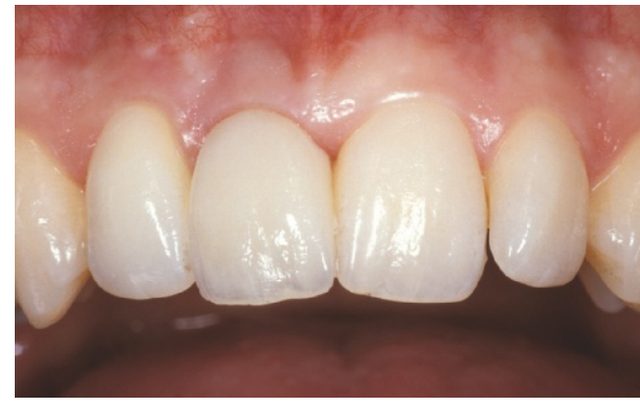
3.9a The effects of soft tissue discoloration are amplified by the metal parts of the crown.



3.9b The appearance improves after switching to an all-ceramic crown.

Fig 3.10





3.10a and b The final result is compromised by soft tissue discoloration.

3.6 SUMMARY

When replacing teeth with implant-supported restorations, it is important to use a surgical procedure that will not destroy the available soft tissue. Failure analysis of one's own cases is a quick way to learn which guidelines must be followed in order to prevent such failures in the future. Many key points that help to prevent tissue destruction from occurring as a consequence of implant therapy are discussed in the following chapters. Conversely, the limits of modern dental implantology are also discussed.

It does not necessarily take an accident or pathological event to produce tissue conditions that do not meet the standards for esthetic success. Sometimes, the available tissue provided by nature simply does not permit an optimal solution. In these cases, as always, the goal of treatment is to make a positive change in the tissues affected. Congenitally missing teeth, for example, are often associated with the presence of bone deficiencies and thin soft tissue. Therefore, sufficient bone and soft tissue volume have to be created. In other words, we have to change the bone and tissue conditions determined by nature in order to be able to achieve an optimal result. Furthermore, our therapeutic efforts are only a success if the optimal esthetics achieved by implant therapy can be maintained over the long term (Fig 3.11). Studies on the long-term stability of esthetic outcomes are scarce,[2,3] but there is an abundance of clinical experience, albeit not positive in every case.

The choice of treatment procedures is a decisive factor that determines whether the goal of achieving a harmonious esthetic outcome can also be maintained over the long term.

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2. Buser D, et al. Long-term stability of contour augmentation with early implant placement following single tooth extraction in the esthetic zone: a prospective, cross-sectional study in 41 patients with a 5- to 9-year follow-up. J Periodontol 2013;84:1517–1527.
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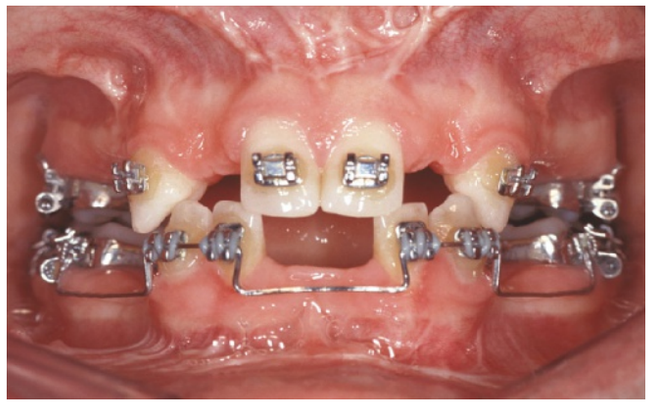
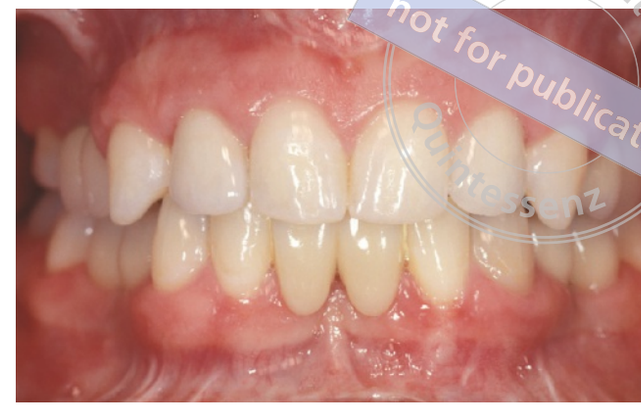
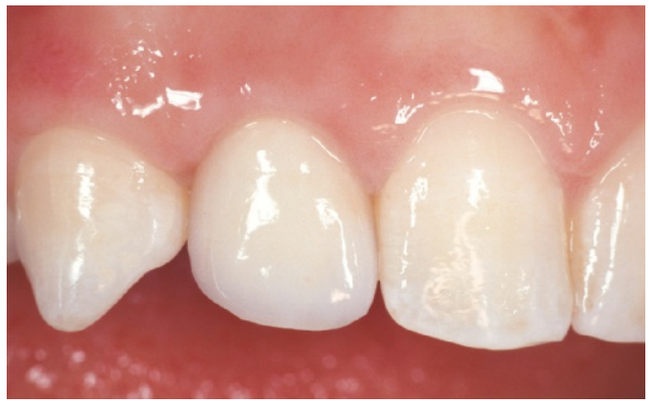


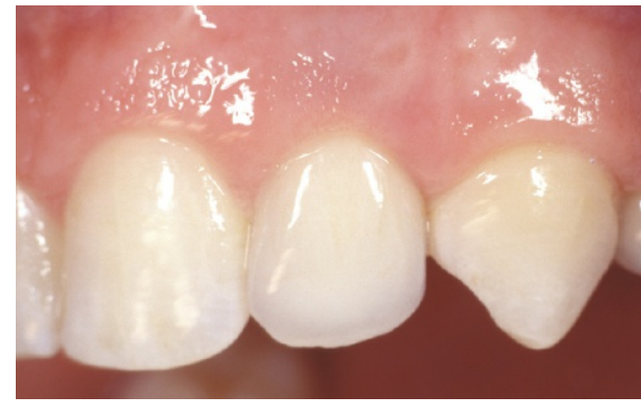
3.11a Preoperative view of site with multiple congenitally missing teeth, some with bone deficiencies and thin soft tissue.



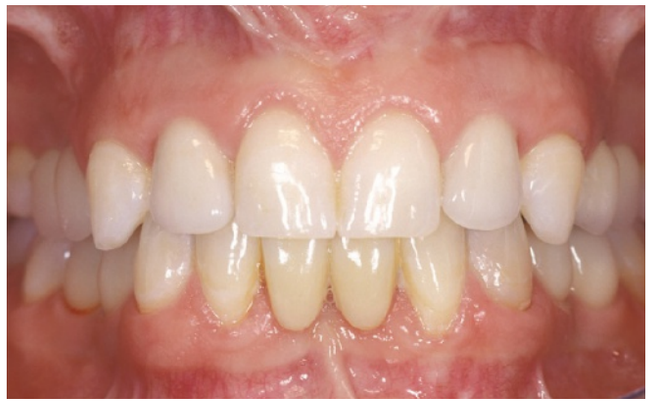
3.11b to d Final result with quantitative and qualitative improvement of tissue conditions.

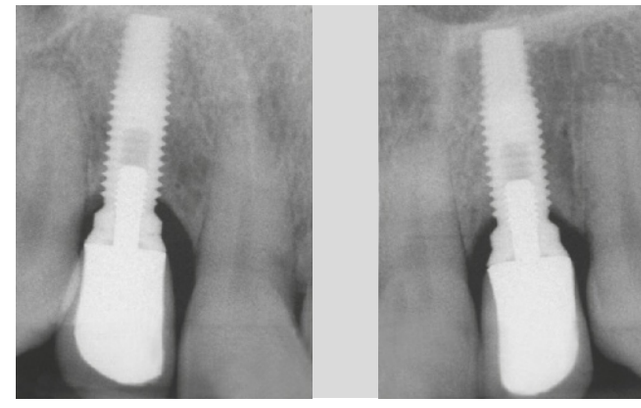


3.11c

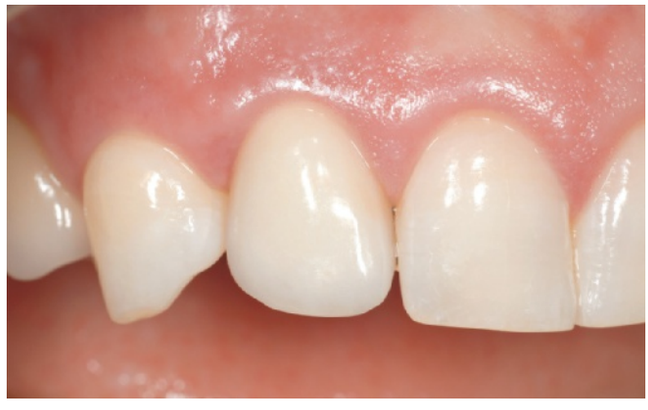


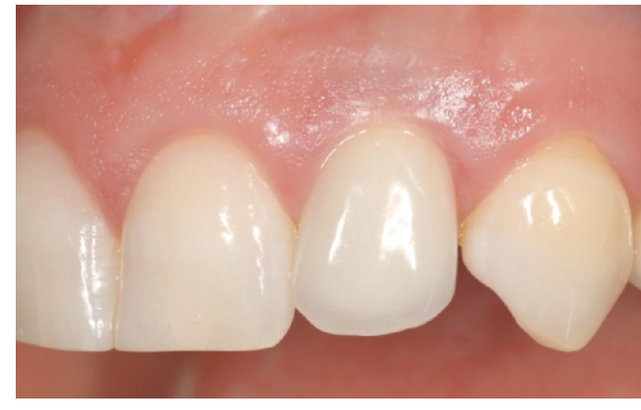
3.11 d





3.11e and f 10-year result.





3.11g and h 15 years postoperatively, the soft tissue is still intact.