Chapter 5

Creating the smile with dental implants

Henriette Lerner

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Biography

Dr Henriette Lerner gained her DMD at the University of Medicine, Temeschburg, Romania, in 1990. She then undertook her Oral Surgery Training at Fortbildungsak Academy, Karlsruhe, Germany from 1990 to 1993. In 1993, she worked in a Private Dental Practice, specializing in Implantology, Periodontology, and Esthetic Dentistry, in Bruchsal, Germany. In 1998 Dr Lerner became a DGZI Implantology Specialist, and in 2002 International Congress of Oral Implantology (ICOI) Diplomate. In 2004 she became a DGOI (German Society of Oral Implantology) Implantology Expert, and undertook Oral Surgery Training at the Carol Davila University of Medicine and Pharmacy, Bucharest, Romania, in 2003 to 2004.

Since 1996, she has worked in Private Dental Practice in Baden Baden, Germany. She has been Associate Professor at the Grigore T. Popa University of Medicine and Pharmacy, Iasi, Romania, since 2011, and Director of the DGOI Study Club, Baden Baden, Germany, and Director of HL Dentclinic since 2012. Dr Lerner is a founding member of the Academy and Seattle Study Club, Baden Baden, Germany. She is also a member of the DGOI, a Diplomate of the ICOI, and a member of the European Association of Osseointegration, Bundesverband Deutscher Oralchirurgen, American Society of Aesthetics, Deutsche Geselschaft fur Aesthetische Zahnheilkunde, Deutsche Geselschaft fur Zahn, Mund und Kieferheilkunde, American Academy of Cosmetic Dentistry, and Internationale Geselschaft für Aesthetische Medizin. Dr Lerner is an Editor Advisor for Prosthetic Implantology Paper, Germany.

I believe

This book represents another beautiful contribution from Professor Deborah Schwarz. She is a part of a distinguished line of female pioneers. I am thinking of remarkable figures such as Clara W. McNaughton (1854–1948), Lucy Hobbs Taylor (1833–1910), Vida Annette Latham (1866–1958), and Leonie von Meusebach-Zesch (1882–1944). I am thrilled to be involved in Prof Schwarz's project.

Growing up as an ethnic Hungarian in Communist Romania, and then moving to Germany, I had to prove my skills and my competence, both as an ethnic minority and as a woman. These challenges, however, taught me a few lessons. First of all, they taught me to refuse to see gender or ethnic background as sources of limitation. Secondly, they confirmed my philosophy that hard work, learning, and perseverance are the only way, and that they need to be driven by the desire to do good and to serve others.

My deeply held conviction, therefore, is that the end goal of our efforts must be to contribute, in one way or another, to the happiness and wellbeing of the broader society; and that our gender, race, ethnicity, or profession, far from being obstacles, are the very tools which allow us to do so.

The changes in the position of women in society have confirmed that gender is not a limitation, but a gift; distinct advances can come from our "emotional intelligence", which I believe represents a special endowment, allowing women to be good leaders, humane, and well-rounded. I would even go as far to say that today's dentistry is "emotional dentistry"; it is an interdisciplinary, comprehensive field, which looks at humans from a holistic perspective, not just a technical one. It puts our top-notch professional prowess in the service of the wellbeing of the entire individual. I believe that we, as women, are very much at home within this holistic approach and this allows us to be at the forefront of the discipline, both as practitioners and as leaders.

Introduction

Implant dentistry is a symbiosis between art and science. It is a great challenge to put together biologic, biomechanical, anatomical, esthetic, and gnathologic knowledge into a treatment plan that offers the patient a satisfying, stable, and functional outcome in the long term.

It is important to provide a lifelong guarantee for the surgical work, and a 20-year guarantee for the prosthetic restoration, which has a certain "material fatigue". In daily practice, and also in teaching activities, clinical workflow must be reliable and include certain predictable parameters and coordinates known to lead to success. However, every case is unique. The challenge is to be able to incorporate into the treatment the techniques and procedures that allow predictability and a fast, effective, and minimally invasive procedure. The aim is to find a treatment plan with benefits concerning minimal invasiveness and high-end esthetics.

The management of the peri-implant tissues is responsible for the natural outcome of the smile. Unpublished results of a treatment workflow used in 120 cases in the last 4 years show a total of 963 implants using immediate implant placement/immediate loading for full-arch reconstructions. Different implant systems were used: Nobel Biocare, MIS, Bredent, and C-tech. The authors concluded that following a certain protocol of treatment, a satisfying result was achieved independent of the implant system employed. The implant systems had the following features in common:

- self-cutting threads
- insertion protocol with an undersized drill in order to achieve good primary stability
- platform switching design.

There were slight differences in the esthetic outcome, depending on the different collar design and on the philosophy of the prosthetic parts. When the protocol was used for adjacent implants, the esthetic outcome resulted in a 100% patient satisfaction.

Philosophy of treatment

Parameters of extraction of a periodontally compromised tooth

When is a tooth periodontally so compromised that it needs to be extracted? When does periodontal treatment become the decision to insert an implant?

Many articles report a high success rate (with no radiographic changes) for immediate placement of implants in fresh extraction sockets of periodontally compromised teeth.[1,2] Although controversial, systemic antibiotics should be used preoperatively, until contrary trials prove otherwise.[3]

Immediate implant placement and loading are proven as clinically reliable procedures with a high success rate.[4-6] From the currently available literature[7-9] and based on experience, it is possible to affirm that:

- the success rate of implant-supported reconstructions in full-arch cases is 97% in the maxilla, and 98% in the mandible[10-13]
- the rate of peri-implantitis is higher when the prosthetic reconstruction includes residual teeth with periodontal problems[14-17]

If the periodontally treated toot is still mobile and infected after 1 year of periodontal treatment, and the residual bone height is less than 10 mm, the tooth should be extracted and an implant placed.

The treatment is minimally invasive, preventing subsequent vertical grafting, in order to give the patient a fixed construction.

Integration of teeth into an implant-supported construction can be performed under the following conditions:

- if the tooth has, according to contemporary studies, statistics, and the author's experience, a prognosis of 20 years, then it can be integrated into the construction
- if the tooth has a prognosis of 10 years, and the prosthetic reconstruction allows the extraction of the tooth, and the prosthetic reconstruction can be sustained with a small modification, then the tooth can be in the reconstruction
- if the tooth has prognosis below 5 years, it is not included in the reconstruction.

Under these conditions, the prognosis of restorations on implants will be 20 years, provided that the patient has occlusion and hygiene control as well as a professional cleaning every 4 months. Within these parameters, individual diagnosis and planning is the next stage.

Esthetic analysis and planning

The esthetic analysis provides a vertical dimension versus a crown height space (CHS) (Figs 5-1 and 5-2). Planning of the reconstruction in a full-arch rehabilitation takes into consideration the vertical bone loss:[18]

- CHS 8 to 12 mm: In this case, immediate implant placement/immediate loading will be possible, with a high predictability of a natural outcome of the pink and white esthetics.
- CHS 12 to 15 mm: In this case, the teeth will be more inclined. A pink component may be needed as part of the restoration. The technician will have to work with a suitable interdental brush in order to allow appropriate cleaning of the prosthesis, which can be cemented or screw-retained.

- CHS > 15 mm: In this case, the patient will have a considerable pink component. Therefore, the restoration will have to be removable or screw-retained. The current tendency is for a fixed construction.

Functional analysis

The functional analysis, instrumental or manual, will be able to diagnose a dysfunction of the craniomandibular and muscular system. It is well known that edentulous or partially edentulous patients might have muscular discoordinations even if no symptoms present.

The discoordination may be drastic if the arch is restored on implants, zirconia or titanium abutments, or e.max crowns, which have no tolerance, resilience, or elasticity. The bite situation has to be thoroughly balanced. Therefore it is understood that the occlusion has to be perfect in centric, habitual, and lateral movements.

Radiologic analysis

A three-dimensional (3D) diagnosis is a *conditio sine qua non* for precise work, especially when dealing with bone defects. It is necessary to know the exact 3D shape and architecture of the defect, in order to know the design of the flap.

Photographic and video analysis

Modern photo and video analysis will make communication with the patient easier by illustrating which parameters are essential for the harmonious integration of the teeth in the orofacial system. The patient is also a 3D "parameter" whose character can be implemented and improved by high-quality white support of the teeth.[18]

Planning

The planning starts with the digital creation of the "golden ratio" of the teeth, transposition to the model, and creation of an esthetic wax-up or mock-up, which will be approved by the patient. In full-arch rehabilitation, there are some dimensions that have to be respected. As the maxillary implants will be inserted in the palatal part of the sockets, the technician has to measure the interpremolar distance to be able to give the dimensions of the initial dental crowns (Fig 5-3).

The overjet and overbite should be reduced to the physiologic dimensions (2 to 4 mm) (Fig 5-4). Big modifications compared to the initial dimensions will

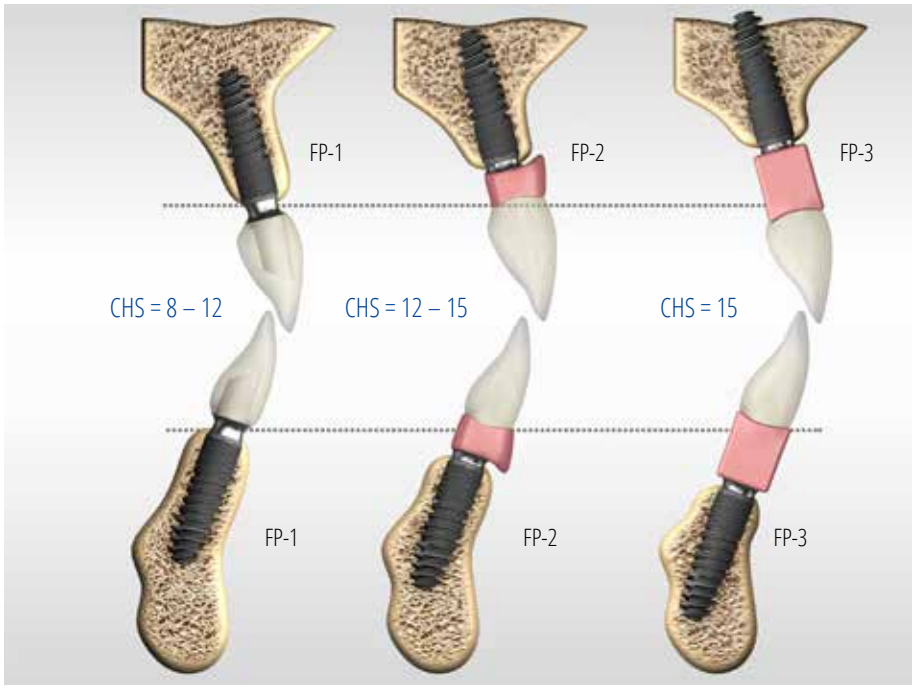


Fig 5-1 Planning of the reconstruction in a full-arch rehabilitation takes into consideration the vertical bone loss (FP, fixed prostheses).

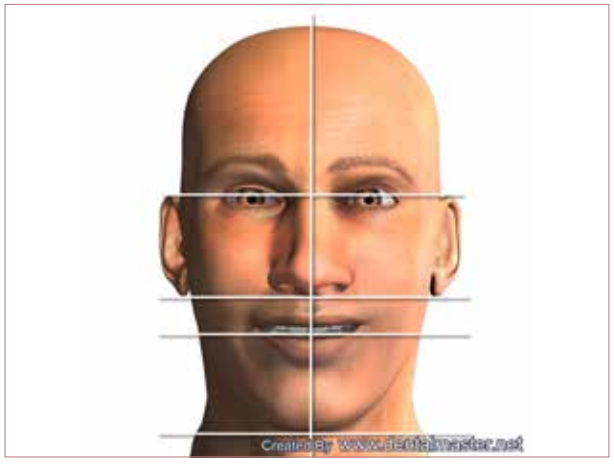


Fig 5-2 The esthetic analysis starts with the symmetry and proportions of the face (created using www.dentalmaster.net software).

Fig 5-3 The measurement of the interpremolar distance at the level of the buccal premolars helps to give the patient the same arch dimensions, despite the palatal position of the implants.

Figs 5-4a to 5-4c The original overjet and overbite dimensions are measured, slightly corrected, and reproduced in the new rehabilitation (created using www.dentalmaster.net software).

cause reduced space for the tongue, phonetic problems, enlarged black spaces, and a narrower jaw dimension compare to the preoperative dimensions. Considering all these parameters, which ensure a common language and workflow with the technician, he/she will be able to create a wax-up and a mock-up of the ideal situation.

Presurgical prosthetics

A try-in of the mock-up will be done if possible. In full-arch rehabilitations on implants the technician will prepare a provisional bridge in advance using the "shell technique" (Fig 5-5).

General health and premedication of the patient is an important issue. In bone grafting procedures one of the important parameters that should be controlled is the vitamin D value. Histomorphometric analysis reveals that the bone-to-implant contact (BIC) ratio and bone volume (BV/TV) around the implant were significantly increased in the vitamin D supplementation group.[20,21] These results demonstrate that vitamin D supplementation is an effective approach to improve the fixation of titanium implants.[21]

Implant placement

Implant placement should be performed according to the following positioning rules:[22]

- 4 mm distance to the buccal contour
- 1 mm below the bone level
- 3 to 4 mm from the free gingival margin to be achieved (Fig 5-6).

Intact sockets should be treated without raising the flap. The gap can be grafted with a nonresorbable material. Thin tissue biotypes can also undergo a connective tissue graft when the socket is intact. When a buccal bone defect is present, the grafting of the socket can be performed with a nonresorbable material and protected (covered with a collagen membrane type III-IV, with long resorption time and, if possible, a matrix able to implement the tissue biotype at the same time) (Fig 5-7).[22]

Implant design

Esthetic rehabilitation is achieved more predictably in implants with a polished collar, set below the bone level, and when a platform-switching design is used. Platform-switching has been shown to prevent bone loss (on average 0.6 mm instead of 1.4 or 1.6 mm).[23-25] A concave profile of the emergence profile will better represent the peri-implant tissue.[26,27]

Fig 5-5 The provisional restoration, created according to a wax-up in a shell technique.

Figs 5-6a and 5-6b Correct positioning of the implants in the extraction sockets.

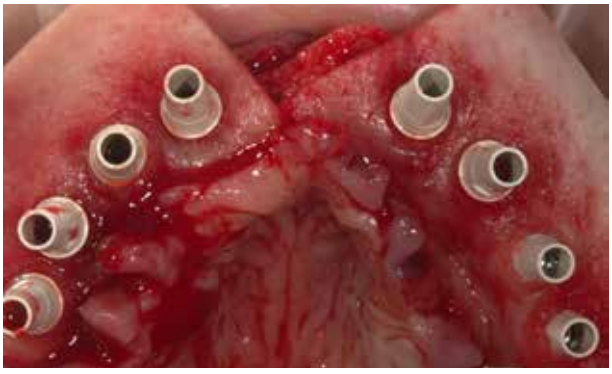


Fig 5-7 Use and fixation of a collagen membrane (matrix) for soft and hard tissue grafting.

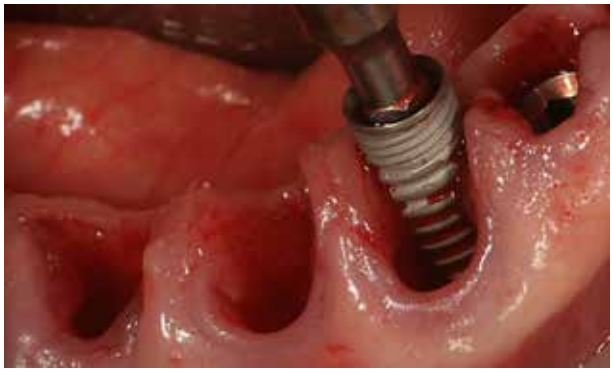


Fig 5-8 Flapless surgery in the extraction socket.

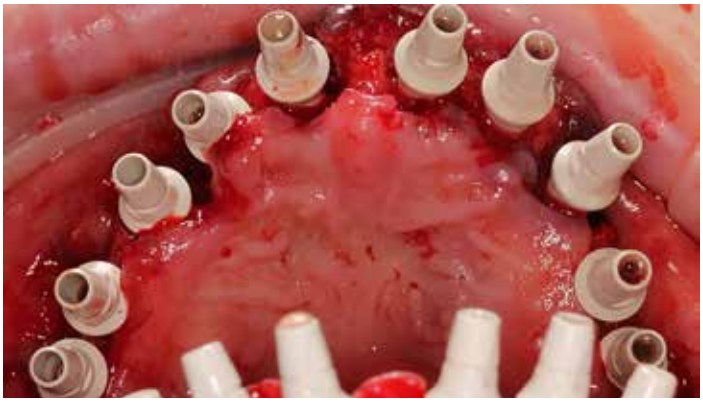
Immediate implant placement, immediate loading

The preconditions of immediate functional loading in full-arch restoration were discussed in the consensus conference in Baden-Baden.[28] The *conditio sine qua non* for loading an implant inserted in an extraction socket is primary stability: three-quarters of the surface of the implant should be covered by bone, and the gap should be grafted.[29,30]

Surgery

Surgery should be performed under full anesthesia. In full-arch reconstructions the rules are similar to those concerning single-tooth replacement. In case the socket is intact, it will be left intact (Fig 5-8). If the buccal plate is missing, or incomplete, after raising the flap, grafting should be performed with coverage with a collagen membrane (Fig 5-9).[22]

Placement of the implant should be esthetically driven. Grafting should follow the rules of defect architecture, and the quality of the host bone. Growth



Figs 5-9a and 5-9b Implant placement with flap, bone grafting, and membrane.

Fig 5-10 PRF membranes for better soft tissue healing.

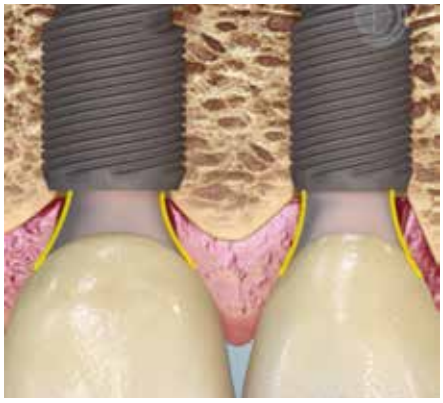
Fig 5-11 Soft tissue result after split-mouth suture technique: right side. Horizontal and vertical mattress suture; left side result after a continuous suture with loop.

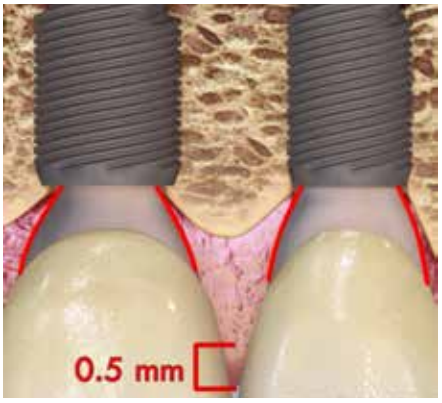
Fig 5-12 Immediate loading with provisional abutments with concave emergence profile.

Fig 5-13 Impression taking after healing, with caps on the same provisional abutments.

factors (platelet-rich fibrin, PRF) can be added to the bone material, and a fibrin membrane can be used to cover the collagen membrane (Fig 5-10). This will contribute to increased vascularization in the first 2 weeks of healing, by promoting vascular endothelial growth factor (VEGF).[31]

After the necessary flap advancement, a horizontal mattress suture, set 1 cm off the incision line, should be placed to ensure a tension-free closure





Figs 5-14a and 5-14b The concave convex philosophy of the emergence profile is used to increase the inter-implant papilla length (created using www.dentalmaster.net software).

of the flap. The gingival part will become attached, and should heal properly through optimal vascularization (Fig 5-11).

It is recommended that the prosthetic parts (healing abutments) be concave, to encourage the recovery of the peri-implant structure (Fig 5-12). The aim is 3 mm of tissue height, 3 mm gingival thickness, and 3 mm width of the keratinized gingiva around implants.[32,33] This should ensure long-term esthetic stability and stability of the bone.

Prosthetic reconstruction/philosophy for maximal esthetic outcome

After the healing, the impression should be taken to reproduce the concave profile of the tissues created, using the provisional abutments as impression copings with the help of an impression cap (Fig 5-13).

In the esthetic zone, individual abutments with a slightly convex profile will contribute to a dynamic but tender compression of the papilla in the inter-implant space. This will help to gain approximately 0.5 mm papilla length (Fig 5-14). Abutments should be constructed individually, using e.max (Ivoclar Vivadent) or a zirconia on titanium base. The preparation limit should be 0.5 mm below the gingival margin (zenith) of the future tooth (Fig 5-15).

The next stage is fabrication of the crowns to imitate the natural dentition (Figs 5-16 and 5-17). The contact points between the crowns is usually 42% to 43% of the interdental space.[34] Single crowns can be produced individually using e.max ceramics (Figs 5-18 to 5-21).

Cementation can be performed using Multilink or Variolink (Ivoclar Vivadent) for e.max ceramics. Cords should be inserted before cementation, to prevent cement rests entering the sulcus, which can cause later peri-implantitis.[35]

The author believes that a patient should have a 20-year guarantee, on condition that they maintain a strict recall every 4 months for hygiene control, including remotivation, occlusion control, and professional cleaning.

All 120 patients treated in the last 4 years with full-arch, fixed restorations using the principles described report satisfaction concerning esthetic outcome,

Fig 5-15 e.max abutments on titanium base fabricated using a CAD/CAM procedure.

Fig 5-16 *(left)* Natural proportions of the contact points and interdental spaces.

Fig 5-17 *(right)* Natural profile of the e.max crowns.

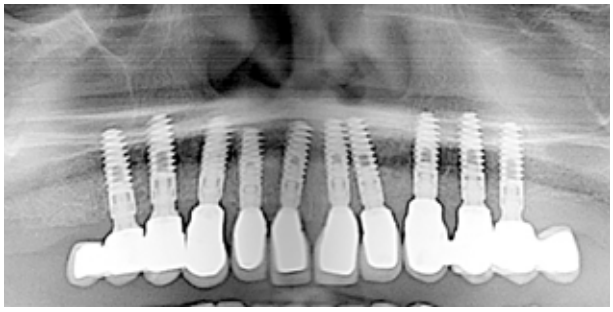
Fig 5-18 *(left)* Zirconia abutments on titanium base: The future crown margin is 0,5 mm below the gingival margin.

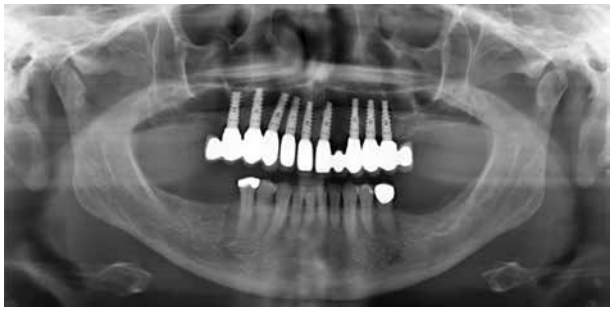
Fig 5-19 *(right)* Natural outcome of the crowns on the implants.

Fig 5-20 *(left)* The slightly convex emergence profile will result in a dynamic but low compression for 30 seconds on the gingiva.

Fig 5-21 *(right)* Crowns with a natural look and feel.

Figs 5-22 and 5-23 Crowns with a natural look and feel, resulting in excellent patient satisfaction.





Figs 5-24 and 5-25 Radiographically stable situation after 4 years.

function, and stability. This personal impression of the patients matches the scientific data, such as high results for pink esthetic score (PES 8 to 10 in 100% of cases; Figs 5-22 and 5-23) and low bone loss rate (8.5% of bone loss greater than 0.5 mm) around the inserted implants (Figs 5-24 and 5-25) (unpublished results)

Conclusion

Using the well-known parameters and rules of implant placement will lead to a predictable and reproducible result.

Esthetic planning requires good communication with the patient and the dental team, based on photo and video documentation.

Being up to date with the latest technologies, materials, and approaches is beneficial for finding new minimally invasive approaches that provide the maximum esthetic result.

Acknowledgments

The author thanks DENTAL MASTER, Tel Aviv (www.dentalmaster.com) for the graphic support. Also, thanks to ZTM Roland Danneberg and ZTM Elmar Petrisor for the excellent technical work.

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