Research article

The Flat One Bridge technique for full-arch edentulism: long term results from a prospective cohort study

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Abstract

Background and objectives. Immediate loading of dental implants was developed in the last years to treat edentulism. In selected clinical situations, the implants can be loaded successfully immediately or just after their placement, although not all clinicians may achieve optimal results. The aim of the present study is to report the success rate of a new technique, the Flat One Bridge (FOB) in a cohort of patients requiring full arch rehabilitation, with a subgroup analysis according to the their clinical status.

Materials and Methods. The study was designed as a prospective cohort study. 48 consecutive patients (24 females), average age 45 years, requiring full arch rehabilitation, were divided into 4 Groups according to their clinical status: 24 in the Native Bone Group (NBG), 8 in the Periodontitis Group (PEG), 2 in the Guided Bone Regeneration Group (GBRG), and 14 in the Fresh Extraction Group (FEG). All patients were treated with FOB on Ossean implants (Intra-Lock, Boca-Raton, FL, USA), and were followed-up for an average of 8 years. The outcome results were measured with the success, survival and failure rates. The statistical analysis was performed with a Fisher's Exact test.

Results. The overall success and implant survival rate of the study population was 95.8%. There were only 2 failures (4.2%), both in the PEG group. Patients in the NBG and GBR groups had a 100% success rate. The PEG showed in majority success. The FEG showed some implant survivals ($p<0.05$).

Discussion and Conclusion. This study shows the effectiveness of the Flat One Bridge to treat full arch edentulism. Most patients had a positive result, that was maintained on the long term.

Keywords. Bone regeneration, dental implants, immediate dental implant loading, maxilla.

1. Introduction

In the recent years, immediate loaded implants were developed to treat edentulism **[1]**. Many publications confirmed that it is possible to load dental implants successfully immediately or just after their placement in selected patients, although not all clinicians may achieve optimal results **[2]**. Osseointegration remains the final objective of all dental implant

materials and implant-supported rehabilitation strategies. For this reason, many researchers have worked during the last decades on protocols and materials to improve it **[3]**. Several techniques based on new implants and prosthetic designs have been proposed throughout the years by different manufacturers **[4]**. Several recent articles proposed new techniques to treat patients in difficult clinical conditions such as fresh extraction sockets and periodontally compromised sites. However, very little data are available on the success rate of many approaches applied to the same materials, and prospective studies are often lacking to validate specific approaches in various clinical situations.

Recently, we published a case report describing a new technique, the Flat One Bridge (FOB), that was developed to provide a simple solution to full-arch immediately loaded rehabilitation **[5]**. This protocol was developed in 2005, and since then it has been routinely applied in our clinical practice **[6]**.

The aim of the present study is to report the success rate of the FOB in a cohort of patients requiring a full-arch rehabilitation with a long-term follow-up. Moreover, we wanted to explore whether different preexisting clinical conditions led to different final therapeutical results.

2. Matherials and Methods

2.1. Population and protocol

This study was planned and designed as a prospective cohort study. Between 2005 and 2007 we included 48 consecutive patients (24 females), average age 45 years, all requiring a full-arch rehabilitation: 42 for the upper arch, 1 lower arch and five complete mouths. Patients were divided into four groups according to the conditions of health of their mouth and bone: 24 with an edentulous alveolar ridge, but large enough to receive the implants, were included in the Native Bone Group (NBG); 8 affected by a severe form of periodontitis in the Periodontitis Group (PEG); 2 requiring sinus-lift, split-crest and regenerative techniques in the Guided Bone Regeneration Group (GBRG); and 14 immediately after a fresh extraction in the Fresh Extraction Group (FEG). All patients were treated with a Flat One Bridge technique.

2.2. Technical details

The procedure called “Flat One Bridge” was developed by Intra-lock International (Boca Raton, FL, USA) during the last years and the research was followed-up especially by an Italian group of clinicians. The concept of this approach allows the creation of a final full-arch bridge within 72 hours from the surgical procedure **[6]**. The implants used have an improved nanorough low Calcium impregnated surface (Ossean) and specific designs adapted to this immediate loading application **[7]**.

The implants were adapted for immediate loading, what means they were placed in function immediately after implantation: eight implants were usually needed for the upper arch, six for the lower arch. The mechanical stress within the first 4 days after the surgical procedure acted during the initial healing phase (inflammation and neoangiogenesis), thus stimulating the following steps **[8,9]**.

The main issue in the treatments of the patients with full-arch rehabilitation was often the problems of axis of the implants. As it can be observed in **Figures 1 and 2**, we often faced damaged alveolar ridges where the implant insertion axes were also guided by the bone morphology and were not ideal for the following prosthetic steps. This could be

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particularly complicated with immediately loaded implants, as the conditions of preparation of an implant-supported bridge just after a significant oral surgery are always more complicated. The particularity of the treatment strategy with flat One Bridge was the use of the flat abutments. Connected to each implants, they allowed to correct immediately and definitively the problems of implant axis prior to the preparation of the implant-supported prosthesis. It was particularly useful in these cases, as immediately loaded implants implied to work in a sensible post-surgical mouth. These flat abutments were used in all these cases, and allow to always use full-arch infrastructures to link and to tighten mutually the implants. With the implant design and surface, they are the main success key characteristics of the materials used in this study. The implant-supported prosthesis was produced using a cobalt-chrome alloy and composite resin, for adequate functional and esthetic results.

2.3. Outcome measurement

The main outcome measurement criteria were the success rate, the implant survival rate and the failure rate.

Success was defined as: no mobility, nor pain at percussion and torsion; the distance between the implant shoulder and the bone ridge occlusal edge equal or lower than 2mm, controlled by a radiological examination; no spontaneous or evoked bleeding - negative probing; a keratinized perimplant gum equal or higher than 3 mm.

Implant survival was defined as: an implant that could support the load even in the presence of conic radiotransparency around the implant collar; a limited number of exposed threads of the implant screws and/or a limited loss of keratinized gingiva.

Failure was defined as the mobility or loss of the implant. The statistical analysis was performed using a Fisher's Exact test to compare results in the different groups.

3. Results

All patients were treated in an outpatients department, and their final prostheses were placed in function 12 to 72 hours after the surgical procedures. No complications or adverse events were noticed at the time of implant-supported prosthesis delivery.

All patients were controlled every 3 months during the first year, and every 6 months from the second year. All the patients were followed-up for a time ranging from 6 to 9 years (average 8). There were no drop out patients.

The overall success and implant survival rate of the study population was 95.8%. There were only 2 failures (4.2%), both in the PEG group **(Table 1)**. Comparing groups, we found that all patients in the Native Bone Group **(Figures 1 and 2)** and GBR group **(Figure 3)** had a 100% success rate. The Periodontitis Group showed in majority success, even if some failures occurred. The Fresh Extraction Group reported several cases of implant survivals **(Table 1)**. All these differences were statistically significant ($p<0.05$). All the failures and the implant survival cases were recorded at the upper arch level.

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	NBG	PEG	GBR	FEG	Total
Success	24	5	2	4	35
Survival	0	1	0	10	11
Failure	0	2	0	0	2
Total	24	8	2	14	48

Table 1. Groups and clinical results. NBG: Native Bone Group, PEG: Periodontitis Group, GBR: Guided Bone Regeneration Group, FEG: Fresh Extraction Group.

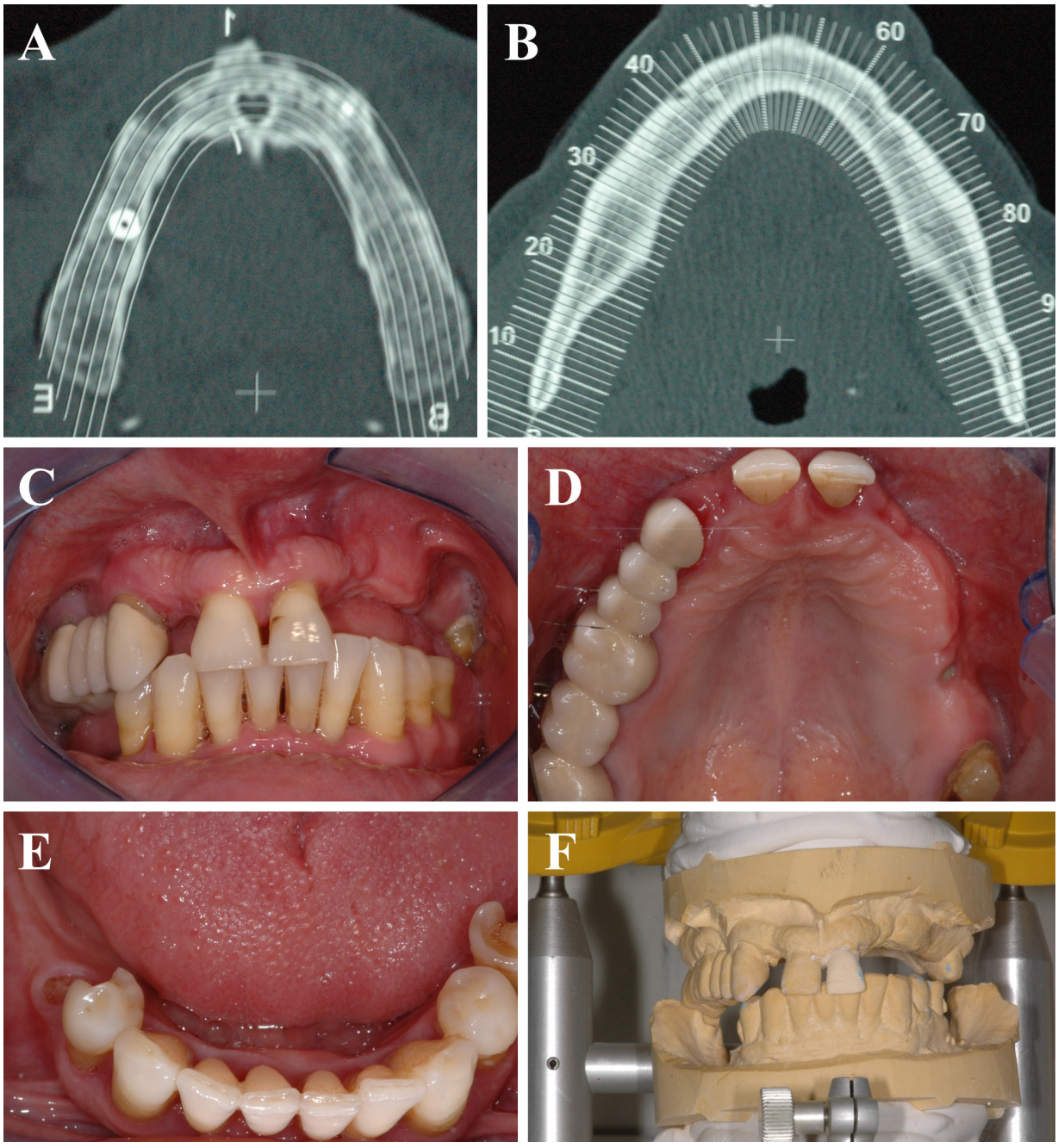

Figure 1. A 40 years old male patient from the Native Bone group. Initial situation. (A) CT scanner of the maxilla before treatment. **(B)** CT scanner of the mandible before treatment. **(C)** General view of the pre-treatment clinical situation. **(D)** Occlusal view of the maxilla before treatment. **(E)** Occlusal view of the mandible before treatment. **(F)** Occlusal analysis of this complex case.

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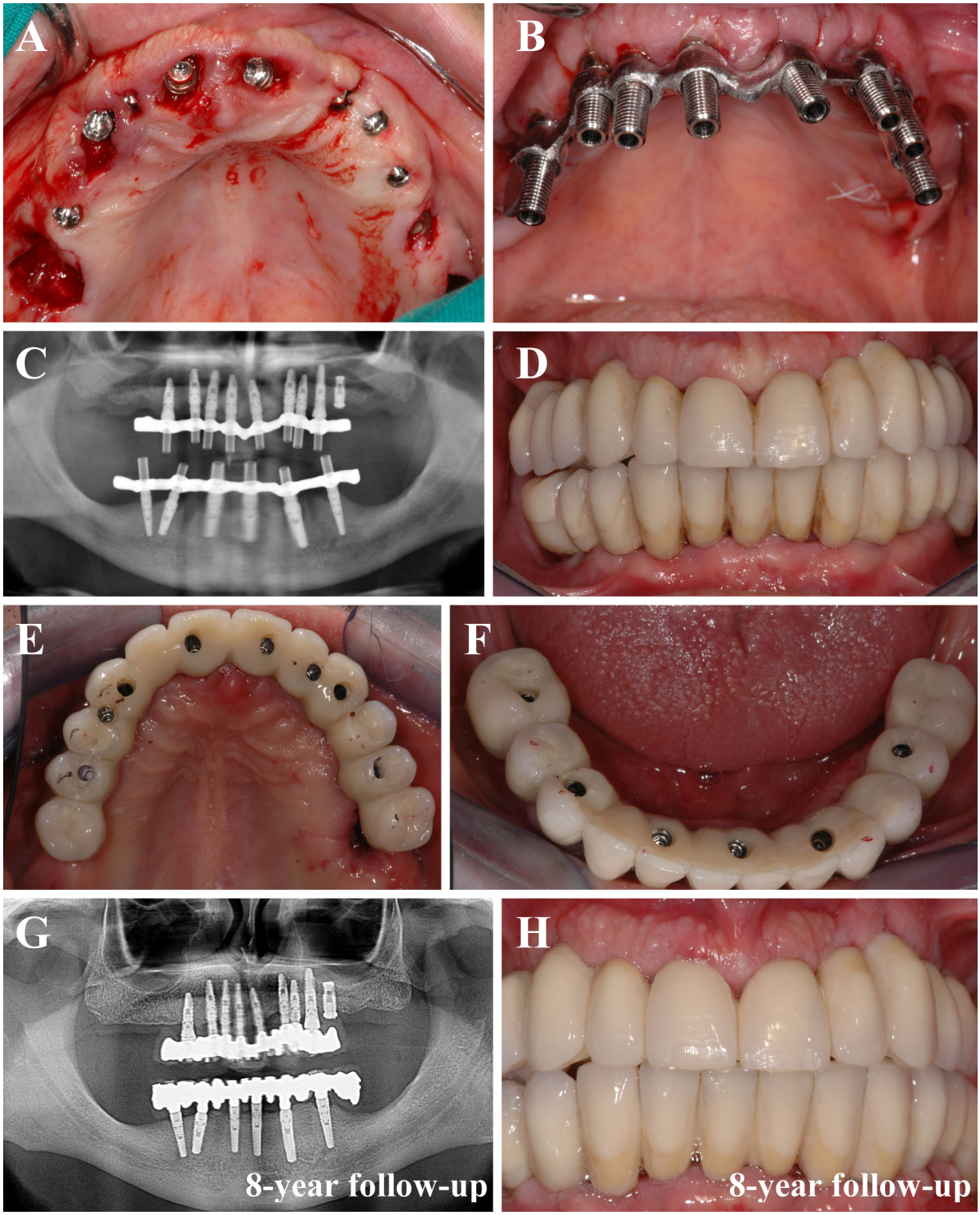

Figure 2. A 40 years old male patient from the Native Bone group. Treatment phases. **(A)** Residual teeth were extracted and implants were placed. **(B)** The prosthetic metallic framework was controlled a few hours after the surgical phase, for adaptation and passive fitting. **(C)** Radiological assessment with panoramic X-Ray a few hours after surgery and with the metallic framework in place. **(D)** Final rehabilitation 72 hours after the surgical phase. **(E)** Occlusal view of the maxillary rehabilitation 72 hours after the surgical phase. **(F)** Occlusal view of the mandibular rehabilitation 72 hours after the surgical phase. **(G)** Radiological control with a panoramic X-Ray after a 8-year follow-up. **(H)** Clinical esthetic aspect after a 8-year follow-up.

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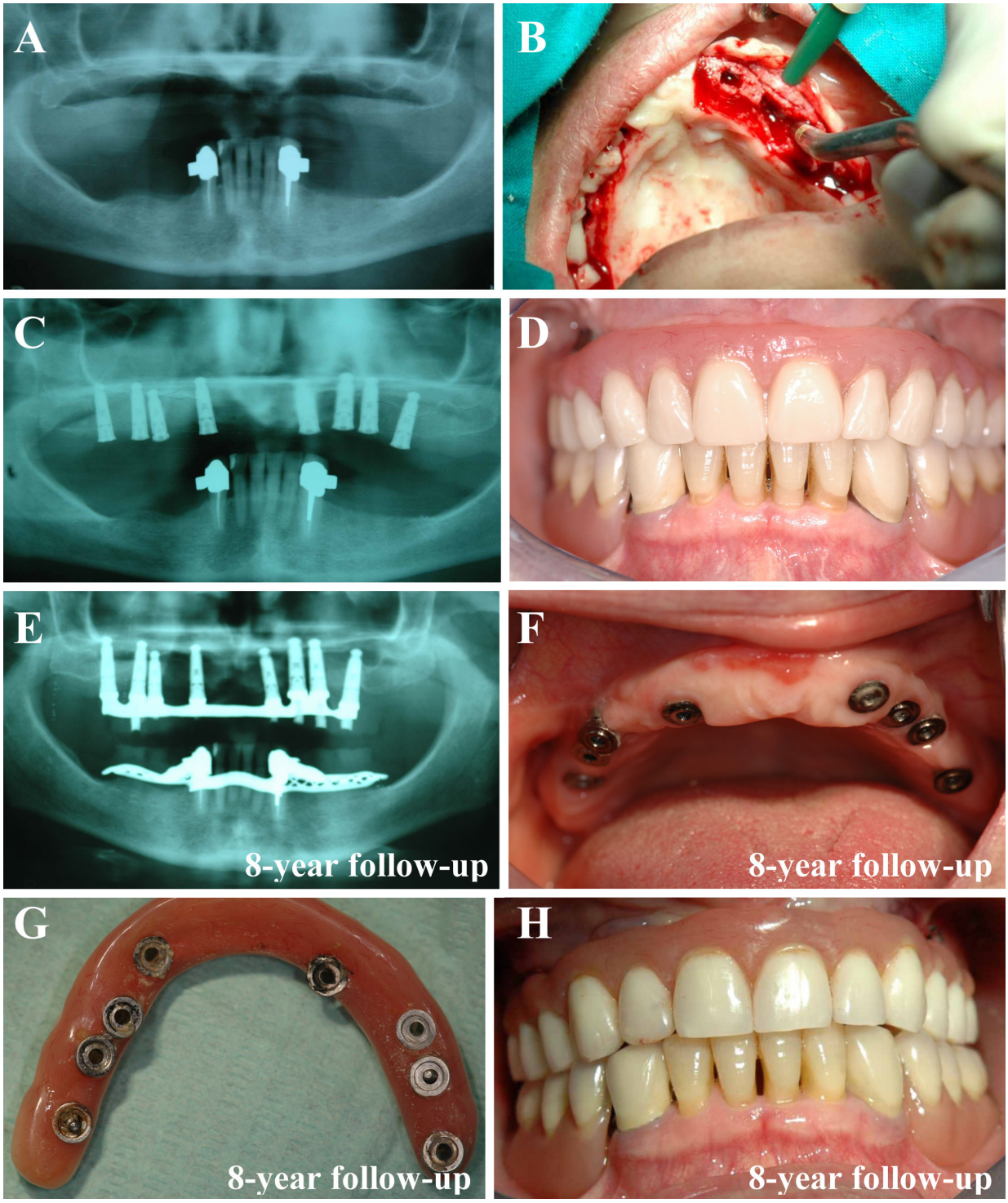

Figure 3. A 70 years old female patient from the GBR group. (A) Pre-treatment radiological assessment. **(B)** Sinus-lift and split crest during the surgical approach. **(C)** Radiological assessment after the surgical treatment. **(D)** Final implant-supported rehabilitation. **(E)** Radiological assessment after a 8-year follow-up. **(F)** Clinical evaluation of the implants, with the prosthesis unscrewed and the flat abutments in position, after a 8-year follow-up. **(G)** Aspect of the implant-supported prosthesis, unscrewed after a 8-year follow-up. Abutments and connections appeared precise and stable after 8 years. **(H)** Clinical esthetic aspect after a 8-year follow-up.

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4. Discussion

Immediately loaded implants are a consolidated technique to treat edentulism, with success rates similar to those of delayed loaded implants, but with the advantage of reduced costs and a shorter clinical protocol **[10,11]**. But in some conditions, there can be technical difficulties in the application of this technique. This is the case in many infectious diseases of the periodontium, systemic diseases like diabetes, hepatic dysfunction and during treatments using bisphosphonates **[12]**. Some reports attributed also a negative impact of smoking on the success rate of this approach **[13]**. However in selected cases, the use of adequate techniques guarantees excellent results **[14]**. The immediate loading approaches are relevant for a single tooth implant treatment, but even more when treating a full arch. In case of a full-arch rehabilitation, the traditional approach was more complex and time-consuming, requiring at least 6 months before the final prosthesis can be positioned. New techniques, like the All-on-Four, reduced these periods signicantly and allowed the fast reconstruction of a functional full-arch **[4,13,15]**. Among these new techniques, the Flat One Bridge was developed at the end of the 1990's - early 2000's to reduce the duration of the provisional prostheses and to help the surgeons in the application of the immediate loading implants **[5,6]**.

The FOB allows an immediate rehabilitation with an esthetic result similar to a traditional delayed fixed prosthesis arch treatment in many clinical conditions. Moreover it allows the use of every residual part of the alveolar space without the need for the crest rectification, thus saving a significant amount of biological tissue and with a similar success rate. Up to now, no direct comparison exists of the different techniques for full-arch immediately loaded rehabilitation, but the comparison of our data with those available in literature shows quite similar success rates **[4,13-18]**.

Our data showed the effectiveness of the Flat One Bridge to treat full arch edentulism. Most of the patients had a functional result, that was maintained during the follow-up period (8 years). Only 2 patients had failures, after 1 and after 3 years respectively. Both of these patients suffered from a periodontitis at the time of the procedure, and this may have had an impact on the final result. Moreover, they were also treated in the early phase of the development of the technique, and this must be considered as a factor which possibly affected the result. Another possible cause of failure is bruxism, as previously reported, but the number of cases in this study is too small to perform an analysis of the impact of this additional pathology **[19]**.

Considering subgroups, we found that in case of native bone, success was achieved in all cases. On the contrary, in the Fresh Extraction Group, a higher rate of implant survivals was reported. This was probably related to the morphology of the implants, which was modified by the manufacturer after the collection of these data to improve the success rate. The implant characteristics, particularly the macrodesign and surface, are key characteristics of an implant system and must evolve and be adapted to each application. The implant system offers now more designs adapted for extraction sockets (particularly the Blossom design). We will soon be able to compare these preliminary data with the results we are now achieving with the updated designs and that we consider even better. In the recent development of the technique, the Flat One Bridge concept became even less invasive and showed an even better esthetic and functional performance, from our experience among the best available for an immediate loading full-arch rehabilitation.

One strength of our study is that our definition of success was much stricter than usually considered, and we added the concept of implant stability, that many authors

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consider as a success **[6,20]**. Moreover, the follow-up from which we considered our results was quite long, making our data more reliable than many short-term studies **[4,15]**.

The present study also has some limitations. First of all, the lack of a control group, but this is not uncommon for first reports of new methods and techniques. Another limit is the small population considered, that made some of the subgroups quite limited. Nevertheless, our statistical analysis showed significant results, so there cannot be any doubt at least about the internal validity. We are still collecting data on the most recent version of the Flat One Bridge implants, and we will soon be able to compare these different implants.

5. Conclusion

Our results show the efficacy of the Flat One Bridge for full-arch rehabilitation. The failure rate was similar to those of other immediate loading implant methods. Further studies including a comparison of different techniques will be useful in the immediate future for a better understanding of the different features of each protocol.

Disclosure of interests

The authors have no conflict of interest to report.

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