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A retrospective study on needle implants positioned in the posterior inferior sector: surgical procedure and recommendations

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ABSTRACT

Introduction: The titanium needle implants received great enthusiasm at the time of presentation, but have recently received negative publicity due to unusual technique and because it requires a specific instrument to be used, such as the intra-oral welding instrument.

Materials and methods: A total of 351 implants were placed during a17 year period (1996-2012) in the posterior inferior sector and welded to a titanium bar using the intra-oral welder. The implants were inserted in atrophic ridges of the D3-D4 bone and were all loaded immediately with a temporary prosthesis.

Results: Overall success of the implants investigated during the years 1996-2012 was 97.1% (341/351); five year success rate was 99% (266/299); ten year success rate was 95.8 % (138/144). Progressive thickening of the bone around the implants was observed.

Conclusions: Titanium needle implants can be used with immediate loading in the posterior atrophic sector, especially in elderly people, in the zone below the maxillary sinus, in the upper front area. They also give stability to other implants. In all cases, intra-oral welding is necessary and requires specific clinical training. Needle implants are not suitable for deep and wide ridges containing dense spongy bone.

Key words: needle implants, titanium, bone, immediate loading.

INTRODUCTION

The needle implants were designed and presented in the early '60s by the French dentist Scialom.[1,2] He understood that, using biomechanical properties related to implant divergence, thin cylinders of metal could ensure implant-prosthetic structure reliability. The needle implant was greeted with much enthusiasm. Several authors provided the press with several publications[3-5] to describe the technique and the implementation of the prosthesis.

Initially, needle implants were made of tantalium. In 1972, Paoleschi, an Italian dentist, published his experiences with the needle titanium implants.[6-7] Due to it's success, titanium then became the material of choice for needle implants.[8]

These implants must be joined together in a stable manner and several authors described the tests on using resin or gold meso-structures.[4,5,9,10] It was discovered that the seal of the resin was unreliable and caused failures due to detachment, while the use of meso-structures was complex and involved the need to leave the patient with implants emerging in the mouth while waiting for metal castings to be constructed. It is important to note that needle implants require a reliable means which allow them to join them together stably.

In the seventies, P.L. Mondani invented the intra-oral welding machine[11] that allows an immediate connection of titanium implants, emerging and submerged,[12] reducing a lot of possible failures. The connection can be made either by welding a bar to the implants or welding the implants directly to each other.

The needle implants are cylinders of titanium provided with a tip that ends with an obtuse angle, as to gently enter the bone tissue (fig.1). They are mainly used in diameters between 1.2 and 1.5 mm. and lengths from 25 to 40 mm. At the coronal end, there are two fins used for mounting on the mandrel that must be mounted on the surgical hand piece. The mandrel is provided with two grooves, which the fins of the needle enter. The mandrel is available in different sizes and lengths. Sometimes, in order to have good visibility in the mouth of the

patient, it’s necessary to use a long mandrel, in other cases a lack of mouth opening requires a short mandrel.

Usually, needle implants go inside the bone tissue with a slow, swirling motion, using a surgical hand piece at low speed (double green ring, 25-30 rpm). The descent into the bone tissue is completed with a concave surgical chisel and hammer, stopping as soon as one hears the typical sound of the cortical bone reached in depth.

Current indications to the technique

Welded titanium needle implants have some specific indications in cases of bone deficit, where the residual bone is sparse and therefore the stability of the implant system is entrusted to the cortical anchorage. The stability provided by anchoring to the cortical bone allows immediate loading. In particular, welded needle implants give very good results in the following situations of bone defect:

1. in the upper anterior esthetic zone, as immediate post-extraction implants (Figs. 2-3);
2. in the posterior inferior district characterized by rarefied bone (D3-D4) (Figs. 4-5-6-7-8-9);
3. in the area below the maxillary sinus (Figs. 10-11);
4. as a support to other implants (Fig. 12).

In the treatment of the lower arch, the welding of a series of deep bi-cortical needle implants guarantees implant-prosthesis immobility, when the bone is rarefied .

Another anatomical site for which they are suited is the pre-maxilla esthetic zone immediately after extraction, when the remaining bone below the socket of the extracted tooth is very little. In fact, you can enter with the implants in divergent directions to use the adjacent bone tissue, obtaining a structure that offers the implant the stability needed for immediate loading.

Another application of the implant technique with divergent soldered needles is the exploitation of the small lamina of spongy bone tissue present between the maxillary sinus and palate, placing a needle in this seat and two buccal.[13]

Although needle implants have excellent predictability of success, in many other locations of the oral cavity, their small size causes problems related to prosthetic outcome so, whenever it is possible and with similar expectations of success, it's better to opt for systems with a greater caliber. It is therefore a technique to use when other techniques are not feasible with a comparable effort / benefit relationship.

Biomechanical aspects

For the correct application of this technique, it is necessary that every needle implant reaches the bicorticalism, according to the Garbaccio's principles.[14,15] The needle enters in search of the impact with the cortex opposite to the point of insertion, then anchoring itself to the more resistant bone. The impact with the deep cortex is an event that can be verified, as it will be described in the section dedicated to the surgical technique.

Like other implant systems, the ideal condition is achieved when an axial load is applied on the needle implants. The divergence with which these implants are inserted, however, allows to have biomechanical conditions favorable even in the case where the applied forces are not axial, providing their application falls within the area enclosed within the apexes of the implants.[4,5] Bicorticalism allows ridges with different densities to be treated, because the forces are downloaded to the compact bone tissue.

MATERIALS AND METHODS

Between 10 January 1996 and 31 December 2012, we used 351 bi-cortical needle implants (ø 1.3 mm) in the posterior (behind the 4th) atrophic lower sector, during 77 surgical

interventions, with immediate welding and loading. The implants were inserted in atrophic ridges D3-D4 bone.

For the study, 85.7% of the patients were female, while male patients represented just 14.3 % of the group. The average age of patients was 61.4 years, in a range from 26 to 83 years (Table I).

Three interventions were conducted on patients affected by hepatitis C, two on patients affected by depression, one affected by bronchial asthma, one patient affected by breast cancer and one of polio. In any case, none of the present or past pathologies here described seem to have any relationship with the outcome of the surgery performed.

Overall success of the implants studied during the 1996-2012 time period was 97.1% (341/351). Five year success rate was 99% (266/299); ten year success rate was 95.8 % (138/144).

The first evaluation of the patients was done using first level X-ray examinations (intra-oral and panoramic). For safety, we also used a TC to decide the direction of insertion of the implants along the side of the inferior alveolar canal.

We used a small amount of local anesthetic in the posterior inferior sector because, as a rule, it is better to not have a complete nerve block.

Because the technique requires that the needle implant must be fit with differing orientations, the incision is important, because it allows you to reposition the gingiva around all the implants, ensuring a proper protection against infection. When there is a band of attached gingiva so wide as to accommodate divergent needles, the incision can be avoided, according to the criteria of minimally invasive surgery.[16]

After the incision, we discovered the bone crest by the periosteal elevator to have a clear vision of the anatomic district. The dissection was minimal when the ridge was thin, so it did not take periosteal bleeding supply off the bone.

After making a small hole, we used a thin gauge cutter, smaller than the caliber of the implant, so as not to lose the sealing of the cortical surface, this being one of the requirements for the stability of these implants. In rarefied bone, we proceed to the placement of the needle implant immediately after making the hole in the cortical surface; in dense bone, we used a thin cutter mounted on a surgical hand piece at low speed, keeping away from the sensitive anatomical structures.

After piercing the bone crest surface, the needle implant was mounted on the mandrel and by a slow rotary motion we arrived at the deep cortical bone. If you are treating the lower back area and need to go along the inferior alveolar nerve side, it is advisable to be careful using a slow rotation, reversing the direction of rotation several times, which makes the descent of the implant[17] much smoother and more accurate. When we arrived at the deep cortical bone, a gentle percussion allows for affirmation of the typical "cortex sound", which gives the diagnostic confirmation that the implant has been placed accurately.

The correct implant placement was verified by intra-operative X-ray examinations, before oral welding.

The surgical sutures, with separate stitches, were made anteriorly and posteriorly in respect to each needle implant. In the event that many needle implants need to be been inserted, more time is required. An accurate suture allows you to create the ideal situation to maintain a proper seal of attached gingiva around the implants. In the case in which the needles are welded together to create a stump, the suture must be done around it.

The needle implants were put immediately in retention after insertion by intra-oral welding of a titanium wire o bar.

In the case of implants adjacent to each other, they can be welded together without adding wires or titanium bars. Where it was not possible to join them directly, we used one bar of titanium to join them together. You can use single or multiple bars, dependent of the need to

give strength to the implant structure. Beneath these bars, no bacterial infiltrations different from those which are found with implants not joined by welded bar[18] were found.

Intra-oral welding can also be made between needle implants together with other types of implants, in order to give the necessary stability for the immediate loading.

The stump obtained by welding together the needle implants is built at the end of the surgical procedure. In the presence of the bar that joined numerous needles between them, was our efforts to put the bar in a correct lingual–buccal position and minimize the undercuts. After preparing the abutment or the bar, we adjusted the provisional prosthesis, immediately putting it in place.

As a preventive measure, the prescription of an appropriate antibiotic was done against the risk of infection.

After we had properly milled the abutment or the titanium bar in the mouth, we took definitive impressions. The final prosthetic restoration was cemented following the same principles of teeth restorations.[19]

The statistical results obtained using this technique with immediate load was the following: overall success of all the implants investigated during the years 1996-2012 was 97.1% (341/351); five years success rate was 99% (266/299); ten years success rate was 95.8 % (138/144). Progressive thickening of the bone around the implants was observed. Some implants were lost because of inflammation, while 3 were fractured. There has never been a report of problems of permanent anesthesia of the lip due to a lesion of the inferior alveolar nerve.

DISCUSSION

The introduction of the needle implants by Scialom arose great enthusiasm in 1962, prompting many newcomers to experiment with this method, attracted by the fact that it’s

possible to obtain high stability with an a traumatic surgery. Some operators employed this technique in all anatomical situations, even those for which the needle technique was not suitable. The means of restraint with which needle implants were joined together in origin was insufficient. These facts, combined with the fact that the knowledge of implant dentistry were fragmentary at the time, led to numerous failures that caused bad publicity for the technique. The invention of the intraoral welder and the identification of precise indications for the technique have radically changed the prospects of success. If the needle technique is used in an appropriate manner, it allows one to obtain significant duration results, as documented in numerous studies.[20, 24-25]

In our experience, we have identified, as additional important indicator of success, the fact that the patient, many years later, returns to the same office to require the same implant solution on the opposite side of his mouth.

Histological examinations demonstrate the perfect osseointegration of these cylinder titanium implants.[21,26]

This surgical procedure has many advantages such as:

1. Fast surgical execution;
2. Minimally invasive technique and is well-accepted in elderly patients;
3. Shortening of treatment time;
4. Suitability for immediate loading;
5. Absorption of forces not in axis with the prosthetic crown;
6. Stability due to implant length;
7. Treatability of ridges with deficits of density and thickness.

Also, there are some disadvantages such as:

1. Invasion, especially in mono-implants, of the adjacent anatomical spaces;
2. Need of a specific training for the technique.

CONCLUSIONS

Titanium needle implant is a valid therapeutic device, useful for dealing with immediate loading cases of atrophy in the esthetic zone, in the lower back area, in the seat below the maxillary sinus and as a support to other implants.

Mandatory requirement is that all the implants are bicortical and connected to each other by intraoral welding. They are not the first choice when the bone crest is thick and deep.

This technique is suitable for cases in which bone is not particularly dense. We have noticed a prevalence of female patients who provided adequate conditions for this rehabilitating solution; in fact, situations in which bone is less dense are more frequent in female patients.

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FIGURE LEGENDS

Figure 1: Needle implant with its mandrel

Figure 2: Three titanium needle implants were placed in the 1.1 area, immediately after extraction of the central incisor with chronic inflammation, and then, immediately, welded together (see the picture about intra-oral welding at right)

Figure 3: Definitive crown after 5 years of function (24.7.2012)

Figure 4: Inferior district: the ridge

Figure 5: Needle implants

Figure 6: The connection by welding a bar

Figure 7: Definitive crowns

Figure 8: Rx control

Figure 9: TC dentascan control

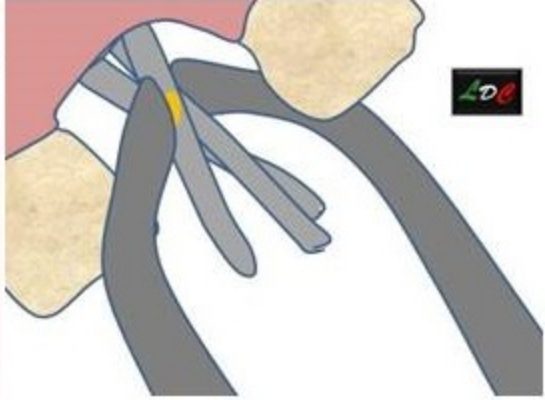
Figure 10: Definitive 1.4-1.7 fix prosthesis on screw implant in the tuber maxillae and three needles implant in 1.4 area, one of which, the longest, is inserted between the cortical bone of the maxillary sinus and the cortical bone of the palate (14.2.2008)

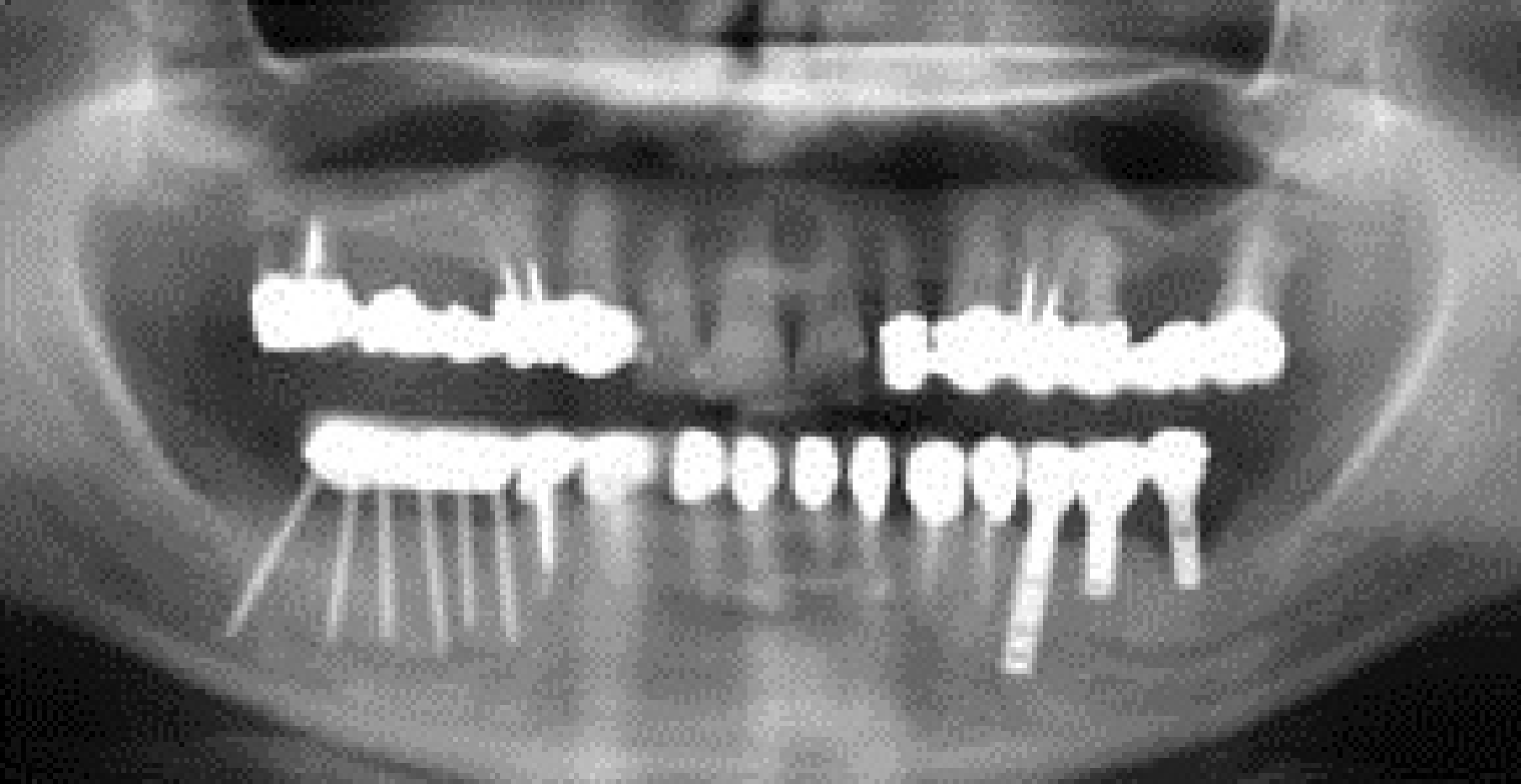
Figure 11: The definitive fix prosthesis 1.4-1.7 of figure 6, after 4 years of function

Figure 12: Screw and needle implant welded together to reinforce anchorage for immediate loading. The low part of the needle runs contiguous to the screw to build a proper prosthetic stump.

Table I: Number of impalnts inserted January 1996 and December 2012

YEAR	AGE	SEX	L SIDE	R SIDE	N.IMPLANTS	YEAR	AGE	SEX	L SIDE	R SIDE	N.IMPLANTS
1996	48	F	4	4	8	2004	56	F		4	4
1996	63	F	4		4	2004	73	F	4		4
1996	63	F		4	4	2004	67	F		4	4
1996	52	F		2	2	2004	69	F		1	1
1996	66	M	1	1	2	2005	45	M	2		2
1996	73	F	3		3	2005	41	M	4		4
1996	73	F		3	3	2005	80	F	4	4	8
1997	57	F		4	4	2005	43	F		3	3
1997	72	F	5	5	10	2005	61	F	5		5
1997	57	F	3		3	2005	67	M	3		3
1997	54	F	4	3	7	2006	47	F	5	4	9
1998	65	F	4	4	8	2006	43	F		5	5
1998	39	F		3	3	2006	70	F		3	3
1999	66	M	6	7	13	2006	65	F	3		3
1999	49	F	5		5	2006	83	F	4	4	8
1999	58	F		3	3	2007	26	F		4	4
1999	44	F	4	3	7	2007	74	F	2		2
2000	53	F	5		5	2007	75	F	4	3	7
2000	58	F	4	4	8	2007	76	F		3	3
2000	56	F	3		3	2007	65	F		4	4
2001	69	F	2		2	2008	58	F	3	4	7
2001	61	F	3		3	2008	65	F	3	3	6
2001	66	F	4	3	7	2008	70	F	3		3
2001	73	F	4		4	2008	61	F	4	4	8
2001	80	F	3	4	7	2009	64	F	2		2
2002	58	F		4	4	2009	68	F		3	3
2002	56	F		3	3	2010	69	F	3		3
2002	54	F		5	5	2010	65	F	1		1
2002	59	M	4		4	2010	46	F	2	2	4
2002	55	F	5		5	2010	74	F	4		4
2003	78	M	4		4	2010	70	F		3	3
2003	38	M	3		3	2010	45	F	4	4	8
2003	72	M	4	3	7	2011	65	F		3	3
2003	81	F	4	4	8	2011	75	M		3	3
2003	38	M		3	3	2011	52	F		4	4
2003	51	F	6		6	2011	71	F	3		3
2003	59	F		2	2	2012	66	F	3		3
2003	72	F	3	4	7	2012	72	F		4	4
2004	66	F		4	4						



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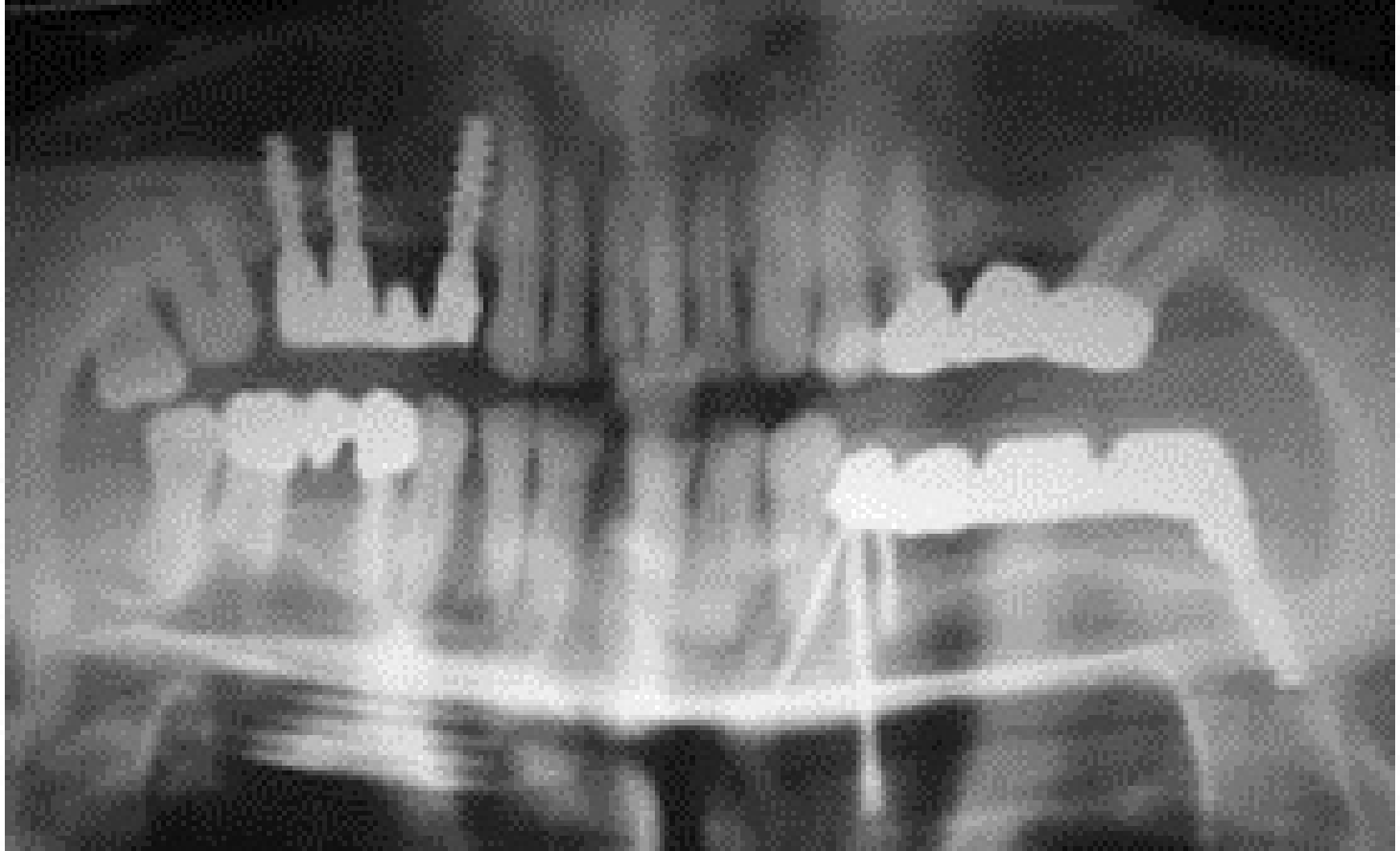


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