Bi-maxillary rehabilitation using the all-on-four method in patients with hypertension: case report and literature review

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Abstract

***Objective*: Cardiovascular diseases (CVD) are diseases of the circulatory system that affect the anatomy and pathophysiology of the heart and blood vessels; hypertension is one of the most common cardiovascular diseases. This case report aims to illustrate the implant survival rate and marginal bone loss in patients with hypertension undergoing fixed prosthetic rehabilitation, according to the all-on-four method, in both arches, at two years of follow-up.**
***Materials and methods*: The patient, suffering from hypertension, presented with severe diffuse periodontitis in both arches. Requiring a fixed rehabilitation, considering a more severe bone loss in the posterior maxillary and mandibular sectors, we opted for rehabilitation with a reduced number of implants according to the "All-on-Four" method. Follow-up visits were performed one week after surgery, after six months, and once a year for the following period (24 months). Any intra- and postoperative complications were noted so that the patient could be monitored. Every four months after surgery, hygiene maintenance sessions were carried out.**
***Results*: No implants were lost during the follow-up period, and no intra- and postoperative complications were recorded.**
***Conclusion*: By promoting reasonable blood pressure control, implant placement in patients with hypertension could be considered a predictable and safe procedure. Moreover, constant patient monitoring and adherence to a strict hygiene maintenance protocol could be crucial to promote implant survival.**

Keywords: Cardiovascular diseases, hypertension, blood pressure, periodontology, oral surgery, dental implants, all-on-Four, systemic diseases.

Introduction

Nowadays, several pathologies, such as cardiovascular diseases, could be considered contraindications to implant surgical therapy, but since in clinical practice, a large number of patients with such pathologies require implant-prosthetic rehabilitation, an effective and safe treatment plan is necessary [1-4]. Cardiovascular diseases (CVD) are diseases of the circulatory system that affect the anatomy and pathophysiology of the heart and blood vessels; hypertension is one of the most common cardiovascular diseases [5]. Hypertension is defined as the chronic increase in systemic blood pressure above a particular threshold value. Blood pressure above 115/75 mmHg increases the risk of developing cardiovascular disease [6]. Hypertension has a prevalence of 20% and is often not easily diagnosed because the symptoms may be absent or non-specific: symptoms such as headaches, mild tachycardia, and lightheadedness are associated with it. If not

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managed correctly, it can lead the patient to unpleasant complications such as hypertensive heart disease (left ventricular hypertrophy and myocardial ischemia), renal failure, retinopathy, and even stroke. Several factors can predispose the patient to hypertension. The first of these is age; blood pressure increases with advancing age, which causes the arterial vessels to stiffen, resulting in hypertension [7]. Other factors are alcohol consumption, sedentary lifestyle, smoking habits, being overweight, and the presence of diabetic diseases [8]. This case report aims to illustrate the implant survival rate and possible intra- and postoperative complications in patients with hypertension undergoing fixed prosthetic rehabilitation, according to the all-on-four method, in both arches, at a two-year follow-up.

Case report

A 55-year-old man came to the Department of Dentistry of the IRCCS San Raffaele Hospital with the desire to undergo implant-prosthetic rehabilitation in both the upper and lower arch. The patient underwent an anamnestic questionnaire from which it emerged that he suffered from a cardiovascular pathology: hypertension. He stated that he regularly took antihypertensive medication, and since the cardiovascular pathology was under control, he was an excellent candidate for implant therapy. The patient's frontal smile can be seen in Figure 1.

Figure 1. Extra-oral photo

On intra-oral examination, it was found that there was severe periodontal disease spread to both arches and that it was impossible to retain the existing dental elements (Fig 2). Among the various treatment options, the placement of implants in both jaws, according to the "All-on-Four" method, was considered the most valid.

Figure 2. Intra-oral photo

Following the signing of the informed consent and the implant-prosthetic treatment, the patient was made aware of the possible intra- and post-operative complications determined by his general state of health. A professional oral hygiene session was performed during the pre-operative phase; afterwards, conventional impressions were taken for the study models and the prosthetic component of the treatment. This was followed by radiographic investigations, which included the performance of an OPT (orthopantomography, a first-level examination) that allowed for an overall assessment of the jaws.
Subsequently, after a CBCT (Cone Beam Computed Tomography, second-level examination) was performed, it was possible to plan the future implant position taking into account the noble and non-noble anatomical structures, both for the upper and lower jaw (Fig 3).

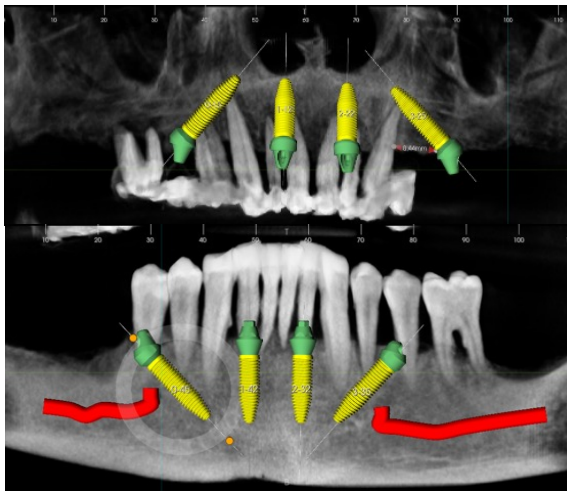

Figure 3. Implant position planning

After all preoperative procedures had been carefully performed, it was possible to schedule surgery, which was performed under conscious sedation by the administration of nitrous oxide.
One hour before surgery, 2g of Amoxicillin and Clavulanic Acid (Augmentin, GlaxoSmithKline, Brussels, Belgium) was administered as a preventive measure. The surgical phase was performed under local anesthesia (Optocaine 20 mg/ml with adrenaline 1:80,000; Molteni Dental, Florence, Italy). As there were dental elements present, which were considered hopeless, they were avulsed (Fig. 4).
Subsequently, the edentulous ridges were incised with a crestal incision and bilateral release incisions from the region of the first molar to the contralateral side and a subperiosteal dissection was then performed on the lingual/palatal and buccal surfaces. A full-thickness buccal flap was then raised in order to expose the buccal bone wall and to obtain an optimal view of the surgical field (Fig. 5).
Once the incisions had been made and the flaps raised, it was possible to move on to implant placement. In the upper jaw, the posterior implants were placed bilaterally immediately anterior to the maxillary sinus, while, in the mandible, the two posterior implants (size length and diameter) (TTx, Winsix, Biosafin, Ancona, Italy) were placed bilaterally immediately anterior to the mental foramen. It is important to emphasize that, following the

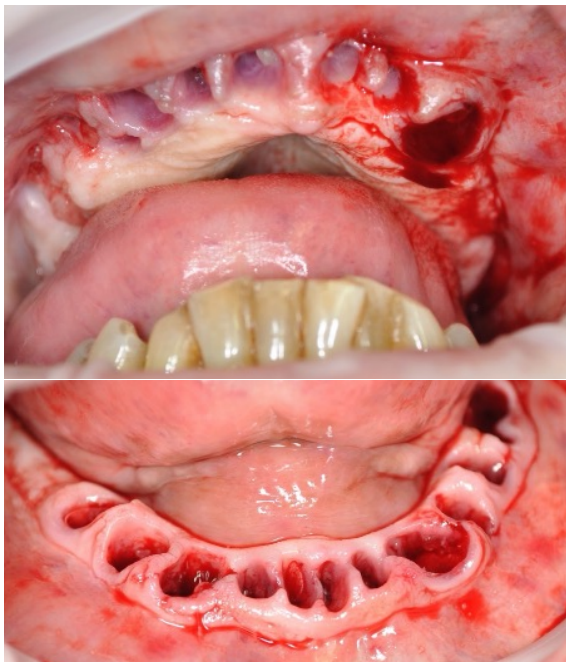

Figure 4. Post-extraction alveoli upper and lower arch

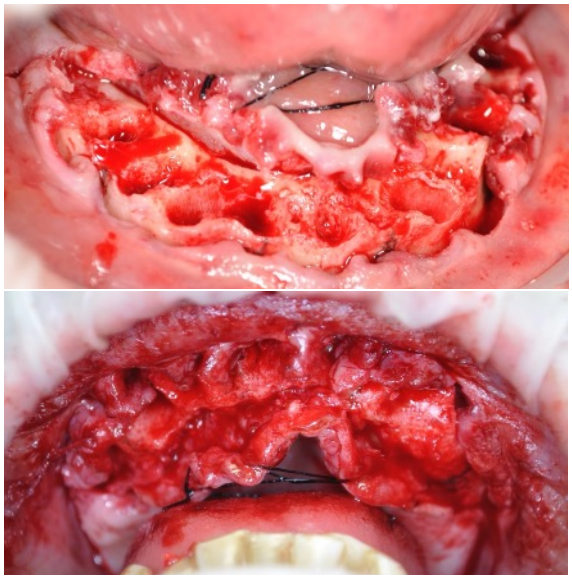

Figure 5. Lifting the full-thickness buccal flap

All- on-Four protocol, the posterior implants are inserted following an inclined trajectory of approximately 25-30 degrees with respect to the occlusal plane. They, in fact, emerge at the level of the second premolar in order to decrease the length of the cantilever and maintain a wide distance between the implants. The central implants, on the other hand, are inserted following a trajectory perpendicular to the occlusal plane in both arches (Fig. 6).
The insertion torque was between 30 and 40 Ncm before final implant placement, thus achieving high primary stability and immediate function.
To compensate for the lack of parallelism between the posterior implants and the prosthetic screw, angled abutments (Extreme Abutment, EA Winsix, Biosafin) were placed at 30°. The anterior implants, on the other hand,

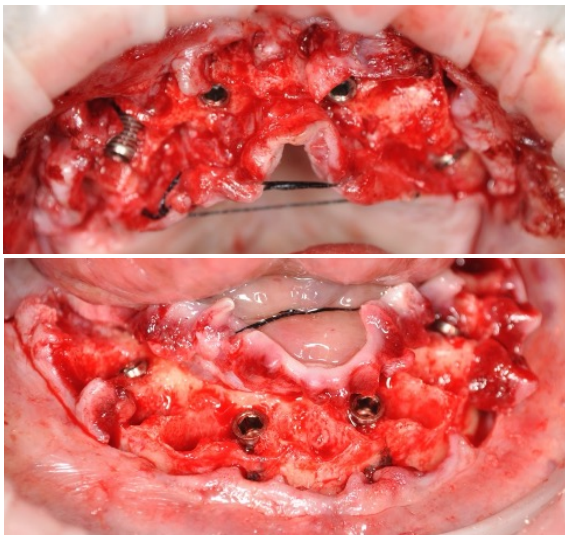

Figure 6. Positioning of axial and tilted implants

were fixed at 17° to allow optimal access for the prosthetic screw.
After these steps, which were essential for the prosthetic part, the previously raised flaps were repositioned and adjusted with 4-0 non-absorbable suture (Vicryl; Ethicon, Johnson & Johnson, New Brunswick, NJ, USA) (Fig. 7).
Immediately after surgery, the prosthetic phase began,

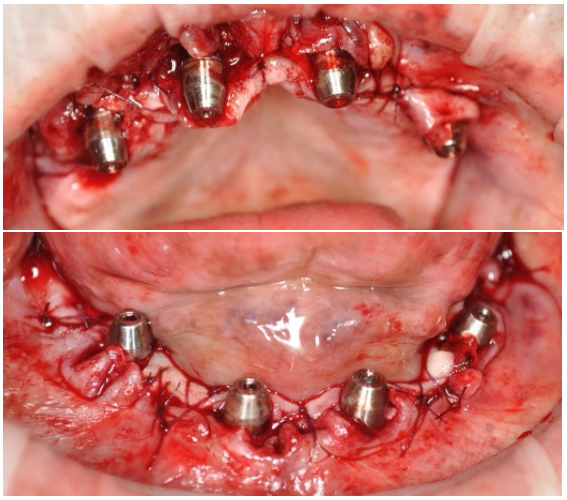

Figure 7. Insertion of the abutments, repositioning of the flap and sutures.

which included the delivery of a provisional prosthesis and the taking of impressions for the fabrication of a definitive prosthesis: a few hours after surgery, a screw-reinforced, metal-reinforced, acrylic provisional prosthesis with ten teeth could be delivered: no cantilevers were used in the provisional prostheses. the torque for tightening the prosthetic screws was 20 N. The screw access holes were covered with temporary resin (Fermit, Ivoclar Vivadent, Naturno, Bolzano, Italy) (Fig 8).
Approximately four months after surgery, the definitive prosthesis will be delivered and, unlike the provisional prosthesis, the latter will have an occlusion that reproduces the patient's natural dentition, i.e. it will have a cantilever distal to the first molar.

Figure 8. Provisional prosthesis

Post-surgical indications included the use of a post-surgical dressing and rinsing with a solution containing chlorhexidine digluconate (0.12% or 0.2%), twice a day for 10 days. In addition, the use of 1 g Amoxicillin and Clavulanic Acid (Augmentin, GlaxoSmithKline) twice daily for 7 days post-surgery and non-steroidal anti-inflammatory drugs (Ibuprofen 600 mg, Brufen, Abbott Laboratories, Chicago, IL, USA) as needed was recommended. Finally, the patient was advised to eat a liquid diet and to avoid any brushing trauma at the surgical site, as well as smoking. The patient underwent a follow-up examination after one week and at the same time the sutures were removed.

Follow-up

Follow-up visits aimed at clinical and radiographic examination were performed one week after implant placement. Thereafter, they were performed every three months, six months, and then annually until a follow-up of two years was reached. A dental hygienist instructed the patient in mechanical plaque control using an electric or manual toothbrush, interproximal brushes, and Super Floss type floss (Oral B, Procter & Gamble, Cincinnati, OH, USA). Professional oral hygiene procedures were performed every three months following implant placement.

Parameters evaluated

Implant survival rate. The implant survival rate is based on the number of implants not lost or removed during the entire follow-up period [9].

Intra- and post-operative complications. Stress and anxiety, or the overdose of vasoconstrictors, can cause a hypertensive crisis, which in turn may lead to acute complications such as myocardial ischemia and stroke. Treatment with antihypertensives may cause hypotension, syncope, fall injuries, and drug interactions with the vasoconstrictors associated with the anesthetic.

Results

Implant survival rate. In the clinical case discussed, the hypertensive patient had controlled blood pressure values, thus adequate for implant placement. During the entire follow-up period, no implants were lost, either in the maxilla or mandible. The survival rate two years after surgery was 100% [10].

Intra- and post-operative complications. Thanks to adequate blood pressure control, the patient did not suffer from a hypertensive crisis during the entire surgical procedure. In addition, he did not report any acute complications during the two-year follow-up. Intraoral radiographs, taken during the follow-up period, confirmed successful osseointegration. They showed intimate contact between bone and implant, with an apparent absence of interposed fibrous tissue. Osseointegration of the patient's implants was favored by correct implant positioning, based on primary stability, achieved with an insertion torque of 30 N [11].

Discussion

Several pathologies, such as cardiovascular diseases, could be considered contraindications to interventions involving the placement of dental implants. However, since a large number of patients with such pathologies require implant-prosthetic rehabilitation, an adequate diagnostic pathway will be necessary to obtain a predictable result from the therapy itself [12-14].

In fact, the general medical and dental history plays a pivotal role during the first visit and allows the clinician to arrive at an adequate knowledge of the patient's general and dental health status. When implant surgery is performed in patients with cardiovascular disease, concerns are related to the possible withdrawal of anticoagulants preoperatively or to changes in blood pressure caused by vasoconstrictors contained in local anesthetics.

The retrospective study by Tonini KR. et al. investigates the association of hypertension and taking antihypertensive drugs with dental implant failure. 1877 implants were placed in a total of 602 patients. 71.43% of the patients were normotensive, while 28.36% were hypertensive. The success rate of dental implants in the normotensive group was 93.98%, while in the hypertensive group, it was 92.99%. In the latter group, the success rate was similar whether they had taken antihypertensive drugs or not. It is, therefore, possible to state that hypertensive

pathology, as well as the use of antihypertensive drugs, cannot be associated with implant failure [15].

Wu X. et al., in a literature review, claim that hypertensive drugs such as beta-blockers, thiazide diuretics, and ACE inhibitors positively affect implant survival [16]. Whereas the use of adrenaline as a vasoconstrictor is not contraindicated. In fact, Montebrugnoli L. et al. demonstrated that the presence of adrenaline does not cause an increase in mean pressure because its use produces less stress than would occur with the production of endogenous catecholamines released following the administration of anesthesia without a vasoconstrictor [17]. Failure to control intra-operative pain could activate important cardiovascular responses [18]. In hypertensive patients, administering approximately two vials of local anesthetic with adrenaline 1:100,000 or 1:80,000 does not significantly alter blood pressure [19]. Following the injection of one vial of lidocaine (1.8 ml) at 2% with epinephrine 1:100,000 (0.018 mgr), plasma levels of epinephrine increase two to three times without causing significant changes in blood pressure and heart rate; three vials increase levels five to six times and are accompanied by hemodynamic changes without symptoms; on the other hand, stress resulting from pain can increase plasma levels of endogenous catecholamines 40 times [20]. This indicates that the cardiovascular response that occurs due to stress is related to the dental procedure rather than the use of anesthetics containing vasoconstrictors [21]. Becker DE et al., on the other hand, argue that despite the beneficial properties of vasoconstrictors, in patients with cardiovascular disease and thus in hypertensive patients, involuntary intravascular injection of adrenaline is associated with adverse cardiovascular effects [22].

In hypertensive patients, stress control in the pre-operative period is essential, in fact, the use of psychosedative techniques, tranquillizers or nitrous oxide is frequently encountered [23]. From the study by Taguchi T. et al., it emerged that the intra-surgical use of intravenous sedation with Midazolam and Propofol could be useful in the treatment of patients with cardiovascular diseases, as it seems to prevent blood pressure spikes and stabilize the patient's hemodynamics [24].

Sitkin SI et al., 2015, investigated the effect of analgesia and sedation during implant surgery in patients with hypertension. The study examined 76 patients; 40 patients underwent implant surgery under local anesthesia alone, while 36 underwent implant surgery under local anesthesia with sedation and preventive analgesia. The combined use of sedation and analgesics resulted in a lower intra-operative pressure than when only local anesthesia was performed [26].

Finally, the authors of this paper wish to analyze the possible correlation between periodontal disease and hypertension. De Pinto R. et al. argued that the underlying reason for this relationship could be a perennial state of inflammation in the body [26]. Inflammation mediators such as proteases, cytokines, and prostaglandins can be released due to local inflammation caused, in turn, by systemic inflammation. Consequently, destruction of periodontal tissue, absorption of alveolar bone, and eventually tooth loss may occur. It appears that individuals with periodontal disease have an increased risk of suffering from hypertension, and in addition, controlling blood pressure may benefit the patient's oral health [27,28]. Sanz M et al. believe that the association between hypertension and periodontitis is independent of common risk factors and may indeed be causal [29]. To further confirm this, it is possible to state a biunivocal relationship between the two pathologies and how important home and professional oral hygiene care is in obtaining a benefit from a cardiological point of view [30,31].

Conclusions

The authors of this paper agree that implant-prosthetic rehabilitation, according to the "all-on-four" method in both dental arches in patients with hypertension and severe periodontitis, is a predictable and safe procedure that allows the restoration of adequate masticatory function. In addition, intra- and post-operative complications can be avoided if the patient is managed correctly.

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