

# Implant-retained overdenture with immediate loading: the experience of an extension program project

**Abstract / Objective:** The aim of this study is to report the experience and results of a university extension program project which proposes to rehabilitate low-income patients with severely compromised dentition, using immediate complete dentures (ICD) for the upper arch and overdenture supported by two immediately loaded implants on the lower jaw. **Methods:** Forty-two patients were selected for the study. In three cases, primary locking was not consistent with the procedure of implant immediate loading. In these patients, the prostheses were captured in a conventional manner after osseointegration. A total of 39 patients received overdenture with immediate loading. Three of them suffered early loss of one of the implants, all in the first month after the procedure. Implants that had been lost were recaptured and replaced three months later. A total of 36 patients completed the period of osseointegration without any implant loss. Patients were periodically evaluated. The oldest cases reached 36 months of follow-up, whereas the newest one was 6 months under control. **Results:** By the time of the latest reviews, no further loss of implants was observed. The survival rate was 96.15%, i.e., only 3 out of 78 implants were lost after immediate loading. **Conclusion:** The project is highly satisfactory in terms of esthetic and functional results. Additionally, it provides significant improvements in quality of life of the assisted population.

**Keywords:** Tooth extraction. Immediate complete denture. Immediate loading. Mastication. Esthetics. Quality of life.

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## INTRODUCTION

Due to being supported by the mucosa covering the remaining alveolar ridge, removable complete denture (RCD) is, without a doubt, the oral rehabilitation method with the worst prognosis, particularly when treating mandibular edentulism. Structures such as the tongue, salivary glands and the mental, buccinator and mylohyoid muscles may impair retention and stability.<sup>1,2,3</sup>

Fixed complete denture supported by osseointegrated implants placed in the pre-mentonian region have proved a good therapeutic option, presenting highly favorable prognosis and providing maximum retention, which is adequate for mastication and consequent patient safety and comfort.<sup>4,5,6</sup>

However, such treatment modality is expensive and of both clinical and laboratorial complexity. Several authors assert that using overdenture instead would be a suitable option, as it is simpler, with lower costs, high clinical success rates and allows removal of the prosthesis by the patient himself, thereby facilitating oral hygiene and control of overnight parafunction.<sup>7-14</sup>

Overdenture acts similarly to conventional complete denture of which support is predominantly mucosal; however, stability is significantly improved by implant support. Overdenture is classified as implant-supported and mucosa-supported prostheses. Several studies have clearly shown the benefits of this rehabilitation treatment modality, particularly with regard to phonetic and mastication aspects. Additionally, they are considered as the best treatment modality in some cases.<sup>8,15,16,17</sup>

When compared with implant-supported fixed complete denture, overdenture is recommended for cases of short vertical spaces between the arches; patients with poor oral hygiene; patients with advanced bruxism; cases of insufficient bone structure for installation of many implants; patients with high horizontal discrepancy between the maxilla and mandible; for financial reasons, given the smaller number of implants required; lower clinical and laboratorial complexity; and smaller number of prosthetic components required.<sup>18</sup>

The aim of this study is to report the results of CPOver (Extension program project in pre-prosthetic oral surgery, immediate complete denture and implant-supported overdenture). The project developed by the School of Dentistry – Federal University of Minas Gerais (FO-UFG) aims at rehabilitating low-income patients with severely damaged dentition by means of immediate complete denture (ICD) for the maxilla and overdenture for the mandible.

## LITERATURE REVIEW

In general, dental treatment aims at maintaining the health of teeth and surrounding structures. However, in many cases, teeth cannot be held in function due to periodontal problems, prosthetic and endodontic failures, fractures, dental caries, external trauma and iatrogenic issues.<sup>1,9,20</sup>

Good reasoning should be used in the treatment planning of patients with severe dental impairment. In such cases, there should be no radical or conservative options. Instead, treatment should be chosen for each case specifically, considering patient's individuality.<sup>21</sup>

When deciding whether or not to extract damaged teeth, the following aspects should be considered for treatment planning: patient's motivation and interest in keeping the teeth; the strategic value of each tooth and whether or not they can be restored and kept in function; and above all, the cost benefit relationship of the necessary procedures.<sup>22</sup>

In this context, the use of ICDs has proved a good choice, as they keep patient's dentate status while waiting for full tissue healing, after which a definite treatment planning can be established. Nevertheless, during follow-up appointments, it is quite common for patients to complain about lack of stability and retention, particularly with mandibular prosthesis, which results in functional and consequent social issues.<sup>17</sup>

For those cases, the use of implants has proved very helpful. Implant-supported overdenture is inexpensive and can be removed by the patient himself, thereby facilitating hygiene of prosthesis and implanted units.<sup>8,23,24,25</sup>

The use of implant-supported overdenture maintains the architecture of the alveolar bone in the anterior region as it does not exert pressure where implants are placed. It is mainly indicated for patients under financial restraints, as well as anatomic or functional limitations, which would make the planning of fixed implant retained prostheses impossible.<sup>26</sup>

There are different ways of planning an overdenture. Planning varies according to the moment of implant placement, the number of implants to be placed, the moment of loading and the kind of retainer to be used.

Regarding the moment of implant placement, there are two basic possibilities: in healed boned or immediately after tooth extraction. There is much discussion about immediate placement of implants in areas with previous periodontal problems. According to Becker et al,<sup>27</sup> there is risk of implant loss due to potential infection. Furthermore, the authors assert that bacteria could cause peri-implantitis.

Sumida et al<sup>28</sup> assessed the transmission of pathogenic periodontal bacteria from the socket to peri-implant tissue. They concluded that eliminating these microorganisms from the oral cavity prior to implant placement could inhibit their colonization, thus reducing the risk of peri-implantitis.

Conversely, Novaes Jr. et al<sup>29</sup> assessed the percentage of bone-implant contact after immediate implant loading in areas infected by periodontal disease. The authors induced the onset of periodontal disease in dogs and used the opposite side of the mouth as control. After 3 months, 40 implants were placed immediately after teeth extraction. After 12 weeks, the animals were sacrificed. Histomorphometric and metrical analyses were carried out and did not show differences between the experimental and control sides, both of which without signs of infection. The authors concluded that fresh, periodontally infected sockets might not be a counter indication for immediate implant placement in that animal model, provided that pre and postoperative care measures be taken.

Vasconcelos and Petrilli<sup>30</sup> demonstrated excellent long-term results with implants immediately placed in sockets with

periodontal disease. The authors recommended the use of a hydrogen peroxide paste to help cleaning and disinfecting the area.

Novaes Jr. et al<sup>31</sup> assessed the influence of micro structure on bone/implant contact of 36 implants immediately loaded in dogs' infected sockets. The authors found good mean contact, with high survival rates for implants installed in periodontally compromised sites, for both types of implants under test.

Casap et al<sup>32</sup> installed 30 implants in infected areas of 20 patients. Pathologies included chronic and acute periodontal disease, endo-perio lesions, periodontal cysts and chronic periapical lesions. Installation protocol included meticulous tissue debridement as well as pre and postoperative use of antibiotics. Results were evaluated between 12 and 72 months. The authors found high success rates and considered this treatment modality as viable, provided that a rigorous protocol was followed.

As for the time of loading, immediate implant loading may cause micro movements, thus increasing the chances of forming a fibrous capsule which would impair direct bone apposition.<sup>33</sup> Other studies highlight that failures in immediate loading mainly occur during the first year, and are usually related to lack of a rigid connection, occurrence of movements, low bone quality, perforation of the lower border of the mandible by secondary infection, and premature insertion in post-extraction socket, all of which is enhanced by poor oral hygiene.<sup>7,9,10,34,35,36</sup>

Thus, some authors recommend the use of temporary implants to support the overdenture while permanent implants

undergo osseointegration or while post extraction healing of the alveolar ridge occurs. Once permanent implants are able to sustain prosthetic loading, the temporary ones are removed.<sup>37,38</sup>

However, Zubery et al<sup>39</sup> histologically demonstrated that temporary implants might osseointegrate, and Simon and Caputo<sup>38</sup> reported that temporary implants might be safely removed from maxilla, while there is a high risk of fracture when trying to remove implants from the mandible after a few months.

Still regarding the time of loading, many studies have been dedicated to evaluate the use of conventional immediate loading implants in the mandible. Implants are usually placed in interforaminal region of the mandible, whereas the prosthesis is connected within a short period of time, splinting them. Most of these studies yield expressive results with high long-term survival rates.<sup>9,13,40,41</sup>

Satisfactory results have also been reported after immediate implant loading with non-splinted implants acting as overdenture retainers. Roe et al<sup>42</sup> evaluated peri-implant tissue response and survival rate of immediately loaded non-splinted implants retaining mandibular overdenture. Eight patients were clinically and radiographically evaluated after three, six, and twelve months. The authors concluded that favorable implant survival rates, as well as favorable peri-implant tissue response can be achieved with mandibular overdenture retained by two non-splinted implants immediately loaded.

Regarding the type of retainer, Burns et al<sup>43</sup> evaluated retention and

stability, tissue response, patient's satisfaction and response, as well as potential complications among 30 patients which received three different types of overdenture, each one of which was used for one year. The authors concluded that the ball system supported by two independent implants showed equivalent or more favorable results than the bar/clip system supported by two and four implants. The bar/clip system supported by four implants presented better retention; however, it proves more expensive and complex. After the experience using three types of overdenture, the authors concluded that patients were more satisfied with and preferred the ball system with independent implants.

#### **MATERIAL AND METHODS: CARE PROTOCOL IN CPOver**

Clinical care is provided in a first-come basis, and starts with anamnesis, intra and extra oral examination, panoramic and periapical radiographs of dentate areas. Once a patient is admitted, he reads and signs an informed consent form before undergoing treatment and taking part as a research subject. He is then invited to answer an Oral Health Impact Profile Questionnaire (OHIP-14) which evaluates the impact of future treatment on his quality of life. Consent and participation are volunteered. All researches and publications have been properly approved by the Institutional Review Board of UFMG. After the initial procedures, treatment planning is established and duly explained to the patient in accordance with the project's protocol and patient's individual needs. Teeth extraction and bone adjustment

of the posterior area, impression, dental casts, intraoral registration, casts mounted in articulator, mounting and trying of teeth, extraction and bone adjustment in the anterosuperior area, maxillary ICD installation, extraction and bone adjustment in the anterior lower area and installation of two immediate implants in the interforaminal area are performed. If good primary stability is achieved (minimum of 60 N), immediate mandibular overdenture is provided with immediate loading. When good retention cannot be achieved, implants are covered with screws, soft tissue is sutured and a regular ICD is placed. The O'ring retention method is used (ball and polymeric ring) due to being easily performed. Antibiotic and anti-inflammatory drugs are normally prescribed before and after surgery. Patients are evaluated after three, seven, fifteen and thirty days, when a new questionnaire is answered. After three months, prostheses adjustments are performed and, if necessary, implants which remained buried and with poor retention are recaptured. All patients are scheduled for follow-up appointments.

#### **RESULTS**

Results are expressed through care statistics, percentage of implant survival rates until the last follow-up appointments and the publication of some finished cases (Figs 1 to 12). A total of 42 patients (22 women and 20 men) were selected to receive immediate mandibular overdenture supported by two immediate implants under immediate loading, regardless of maxillary prosthesis placement. All patients should require teeth extraction



**Figure 1.** Initial case - extra oral view.



**Figure 2.** Initial case - intra oral view.



**Figure 3.** Incisive teeth splinted with steel wires and extracted as a group.



**Figure 4.** Finished prosthesis and connected O' ring capsules.



**Figure 5.** Implants installed in sites B and D. 15 -day post-operative control. Note the need for adjustment in the left anterior area.



**Figure 6.** 6-month control.



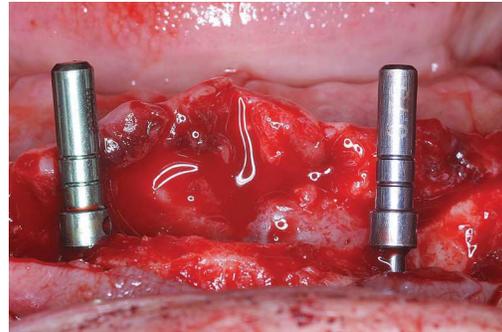
**Figure 7.** Initial case - extra oral view.



**Figure 8.** Initial case - side view.



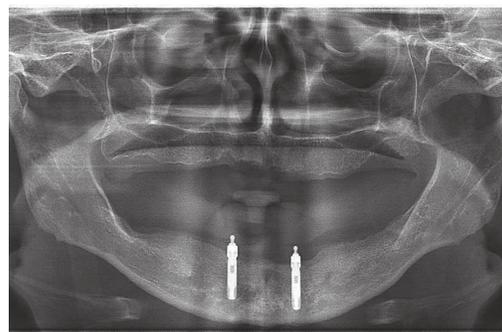
**Figure 9.** Initial case - intra oral view.



**Figure 10.** Use of paralleling devices to determine the best course for implants to be installed in sites B and D.



**Figure 11.** 30-day postoperative control.



**Figure 12.** Panoramic radiograph after 30 months - 15-mm length implants.

in the lower anterior region. A total of 39 patients were actually treated as planned. In three patients, at least one implant did not achieve necessary final torque, in which case implants remained under soft tissue and patients were advised to continue with the non-captured immediate complete denture. Implants were reassessed and captured after osseointegration. Late loading cases showed a survival percentage of 100% until the last follow-up appointment; however, they are not considered in this study.

Of the 39 immediately loaded patients, three lost one of the implants within the critical period of one month after surgery. After full debriding of the area of the lost implant, each patient was instructed to continue using the overdenture supported

by the remaining implant, only. Three months afterwards, new implants were placed and left under soft tissue. After three months of osseointegration, the implants were also connected to the prosthesis. Those three cases in which immediate and late loading were performed, showed 100% survival rate.

Table I shows the survival rate of implants captured under immediate loading, totalling 96.15%, meaning that 75 implants survived and only three were lost (3.85%). Implants were considered as survivors when pain, mobility, suppuration, edema and peri-implant inflammation were not present.

A total of 36 patients completed the osseointegration period without losses. They were then evaluated each semester.

**Table 1.** Survival rate of implants captured under immediate loading after three months

n = 78 implants captured under immediate loading		
Condition at three months	Number of implants	Survival rate
Survivors	75	96.15%
Lost	3	3.85%

**Table 2.** Treatment survival rates according to the maximum follow-up period.

n = 36 patients received overdenture over immediate loading implants and showed no losses after the critical period		
Number of patients	Maximum follow up period	Survival rate
6	36 months	100%
5	24 months	100%
7	18 months	100%
8	12 months	100%
10	6 months	100%

The oldest cases reached a 36-month follow-up period, while the most recent ones have been under control for six months. After the initial critical period, there were no further losses of implants until the last appointment. Different evaluation periods are a consequence of the different moments in which patients were treated. Table II shows the survival rate of implants according to their maximum follow-up period. In each appointment, prosthetic components were evaluated and replaced whenever necessary. The most common occurrences were replacement of polymer rings, a procedure that should be carried out every six months as recommended by manufacturers; and reattachment of metal capsules. Additionally, one fractured post was replaced.

## DISCUSSION

Some factors such as loss of insertion, probing depth, degree of mobility, dental caries, tooth positioning, number of remaining teeth, oral hygiene, prosthetic and endodontic needs, and total treatment cost should be considered as they interfere in the final planning and decision of whether or not teeth should be extracted. For patients whose teeth will be extracted, the waiting period for post extraction alveolar healing can be seen as an inconvenience, either because of the long time required for final prosthetic rehabilitation, the difficulty or even the impossibility of wearing prostheses, particularly in the lower arch. For this reason, clinicians have drawn great attention to the development of new treatment methods, such as immediate loading, which aim to maintain esthetics and masticatory function.<sup>44,45</sup>

Based on previous studies, the university extension program project CPOver works with maxillary ICD and mandibular implant-supported overdenture under immediate loading. That approach has proved highly satisfactory for patients with seriously damaged dentition, providing patients with shorter treatment time, low cost and the possibility of keeping their dentate status with the advantage of maintaining family, social and professional relationships. Later on, with a more favorable oral condition, the patient might seek more sophisticated treatment options, such as fixed implant-supported prostheses.

The choice of the interforaminal area of the mandible for implant placement follows the same approach of fixed implant-supported prostheses. This area usually presents enough bone height, density and absence of vital structures such as the mandibular canal. According to MISCH,<sup>46</sup> the mandible is divided into five bone columns, from right to left, classified as A, B, C, D, and E. These columns are suitable sites for placing implants. Sites B and D have been the choice for patients involved in the project. Depending on the case, particularly in the presence of large and deep sockets, sites A and E have been chosen. Patients might choose a more sophisticated treatment in the future, given the maintenance of enough areas for future implant placement, for example.<sup>46,47</sup>

Overdenture is an option that might act either as an intermediate or definite treatment choice, if implants succeed and patients feel comfortable with it. When a patient is subjected to extraction of all teeth in a dental arch, there are basically two ways of performing immediate loading: with conventional or temporary implants.

Aiming at cost and time reduction, CPOver opts for permanent implants, rather than temporary ones, despite the risks involved in such treatment choice. Although some implants might get lost, this treatment modality is seen as a good choice when aiming at patient's comfort, in comparison with conventional immediate mandibular full dentures which usually show poor stability and retention.

The three patients who lost one of the implants during the critical period were still benefited, for they were still able to use an overdenture supported by the remaining implant. After placement of a new implant and its osseointegration, the prosthesis already in use was recaptured and the case normalized.

With regard to risks involved in immediate implant placement, immediate implant loading and the use of periodontally diseased sites, the literature brings many reports. Those yielding successful results include a protocol meticulously performed, which has been followed in the project: full alveolar debridement, osteotomy, complete rinsing, pre and postoperative antibiotics, sub milling for better primary stability, use of long implants, careful occlusal adjustment, recommendation for night over prosthesis removal and a softer diet for the first three months.

Nevertheless, implant placement in periodontally compromised sites,

immediate loading and the use of permanent, rather than temporary implants represent a true challenge for clinicians and patients. Many studies have clearly shown the benefits of that rehabilitation treatment modality, particularly in relation to phonetic, esthetic, masticatory, and social aspects, at a low cost.<sup>8,16</sup>

Follow-up appointments after prosthesis installation reveal excellent survival rates, as well as patient's satisfaction with tremendous boost of their self-esteem. These results are in accordance with other authors' reports which found high survival implant rates and relate rehabilitation to a qualitative enhancement of patients' perception about Dentistry and their own quality of life.<sup>5,16</sup>

*"The project has changed my life: I've got a job promotion and will soon get married"*

*C. P. S. - 38 years old - patient treated at CPOver in 2010*

## CONCLUSION

The survival rate of immediately placed and loaded implants supporting overdenture and evaluated between 6 and 36 months was 96.15%. The project has reached highly satisfactory clinical, esthetic and functional results, boosting patients' self-esteem and quality of life.

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