

## Revolution of Implant-Supported Prosthesis for Partially Edentulous Patients

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Worldwide aging of the population and oral-health-related prevention policies are increasing the number of partially edentulous individuals, while the prevalence of complete edentulism is being reduced.<sup>1</sup> Changes in tooth loss pattern are important since the retention of teeth at advanced ages is crucial to maintain the masticatory function and nutrition of elders. According to a consecutive cohort population study, following more than 1800 patients, each remaining tooth at age 70 decreased the 7-year mortality risk by 4%.<sup>2</sup> In addition, proper and functional chewing stimulates the cerebral cortex activity and may be helpful in preventing brain function degradation and senile dementia.<sup>3</sup>

A severe reduction in the number of occluding teeth, especially in the posterior region, leads to chewing impairment, being the molar and pre-molars key factors to the comminuting process.<sup>4</sup> Loss of posterior occlusion also jeopardizes jaw movement coordinating because partially edentulous patient tends to chew the bolus in the anterior region.<sup>5</sup> The presence of mechanoreceptors in the periodontal ligament of the remaining teeth maintains the proprioception, helping patients to recognize the food properties, consequently explaining their anterior chewing pattern.<sup>5,6</sup>

To compensate the masticatory handicaps, partially edentulous patients have a tendency to chew longer, overcook their food (reducing its nutritional value), select softer and less nutritive diet, swallow larger food particles, and refuse foods that require significant chewing, such as raw vegetables, fresh fruits, stringy meats, and dry breads.<sup>4,7</sup> All of these adjustments on diet composition and patient's behavior, commonly observed after tooth loss, maybe contributing factors to the higher incidence of digestive problems, frequently detected in older population, and the increased mortality risk observed with the growing of tooth loss.<sup>2</sup> It also highlights the importance of the prosthetic treatment in restoring this compromised masticatory function after the posterior teeth loss.<sup>8</sup>

All prosthetic treatments aim to recover the masticatory capacity of partially edentulous patients, including conventional removable partial dentures (RPD), implant-retained removable partial dentures (IRPD) and implant-fixed partial dentures (IFPD).<sup>9</sup> However, only few evidences are available to determine the relative chewing effectiveness particular of each treatment and, ultimately, to recommend one prosthetic intervention over another for patients with partial edentulism in the post-canine rehabilitation.<sup>8-12</sup> By means of the results of such studies, clinicians could better understand the chewing process, peculiar to each prosthetic treatment, recognizing different aspects of the mastication which includes the chewing pattern, bite force, masticatory performance, swallowing pattern, masticatory muscle thickness, among others.

Overall, the use of implant-based prostheses by partially edentulous patients significantly increases the bite force and chewing capacity, with consequent growth observed in masseter muscle thickness during maximum contraction.<sup>4</sup> Fixed implanted-supported prosthesis followed by implant-retained RPD are responsible for the most efficient recovery of the mastication. To summarize, comparing masticatory parameters between conventional RPD and implant-based prostheses, it was observed that maximum bite force increased by up to 79% and 171% after IRPD and IFPD use, respectively, while the masticatory efficiency increased by up to 91% and 62% when comparing the same prosthetic conditions.<sup>9</sup> Astounding results were also observed in swallowing threshold analysis revealing that, as the retention

and stability of the prosthesis increased by the use of implants, the number chewing cycles necessary during the mastication was reduced, while the size of the swallowed particles became also smaller, showing of the overall improvement of the chewing process.<sup>8</sup>

The use of implant-based protheses significantly reduced the total masticatory cycle time, as well as the opening and closing time.<sup>13</sup> It is a consensus in literature that the faster the chewing rate, the more efficient is the chewing process, which might explain the higher masticatory capacity of partially edentulous patients observed after the rehabilitation with IRPD and IFPD. Similar results were also observed in terms of subjective analysis of the protheses by the patients, with increased oral health quality of life<sup>8</sup> and greater satisfaction regarding retention, comfort, and masticatory capacity after the use of the implant-retained and-supported RDPs.<sup>11</sup>

In regards to nutrition, not only the masticatory function is important, but it also depends on other influencing factors including habits, taste and cultural customs, as well as financial and organizational aspects. In spite of that, significant increasing in fiber, calcium, and iron intake were found after the use of implant-based protheses, even without any dietary instruction.<sup>8</sup> Whole grain products and the skins of raw vegetables and fruits are important sources of fiber, which facilitates the digestive transit, decreases plasma cholesterol levels, reduces the glycemic response to carbohydrate-containing meals, and reduces the prevalence of colorectal cancer.<sup>7</sup> Increments in calcium intake could also improve the bone health, structure, and function, reducing the risk of osteoporosis and osteoporosis-related fractures, while the higher levels of albumin and iron may be linked to the higher consumption of meat. All these results corroborate to the idea that improved masticatory capacity is associated with a greater possibility of healthier food choices by partially edentulous patients.<sup>4</sup>

When comparing conventional to implant-based prosthesis, the removable options present some advantages which includes an easier oral hygiene and prosthesis maintaining, lower cost of the overall treatment, and replacement of a larger number of teeth with only one structure. On the other hand, distal extension RDPs, especially the conventional ones, are associated with challenges, which include the limited stability and retention of the prosthesis due to rotational movement, discomfort caused by food retention on the residual ridges and the unaesthetically appearance of the clasps.<sup>10</sup> Periodic relines are also required to maintain the occlusal contacts and to avoid deleterious forces that may increase alveolar reabsorption or damage to the abutment teeth.<sup>11</sup>

As supported by recent studies,<sup>8,9,14</sup> partially edentulous patients can be successfully treated by osseointegrated implant therapies, with either fixed or removable partial implant-based protheses. However, the fixed implant-supported prosthesis requires the use of more implants when comparing to the implant-retained RPD.<sup>10</sup> In this sense, the poor bone quantity and quality of the posterior mandible and difficulties related to the position of the inferior alveolar nerve may impair the installation of several implants. In such cases, the installation of one single implant in the posterior region associated to an implant-retained RPD (Figure 1) improves the chewing performance, increases patient satisfaction, and it is less expensive than fixed dental protheses. On the other hand, these posterior single implants, installed under the acrylic base of IRPD, may undergo different mechanical forces when compared to implants supporting fixed prosthesis, which might interfere in the longitudinal performance of IRPD. In contrast, in previous study evaluating the 8-year clinical performance of implant-retained RDPs, reported a 93.7% success rate for the conventional-length implants and 100% success for implant-retained RDPs.<sup>14</sup>

In addition, the use of short or small-diameter implants to prevent additional surgical procedures (such as bone grafts or nerve transposition) seems to be promising alternatives for the posterior region. However, no literature regarding such follow-up treatment is available yet. Longitudinal clinical trials are needed to confirm the long-term stability and success of the implant-retained RDPs and the performance of short implants as a support for this type of prosthetic treatment. In spite of that, all the positive results related to the use of conventional implants and implant-retained RDPs support the overall use of such treatment. As a clinician, aware of all the advantages related to the IRPDs, we must have to spread this knowledge towards our partners, aiming to benefit several patients with this simple and low cost treatment based on the additional retention provided by the placement of a single implant under the base of conventional RDPs.



**Figure 1:** Installation of a single implant and a ball abutment in the posterior region to transform a conventional removable partial denture into an implant-retained removable partial denture, increasing prosthesis retention and stability with consequences to masticatory capacity.

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