

COMBINATION SYNDROME: A LITERATURE REVIEW OF GENERAL ASPECTS AND TREATMENTS

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ABSTRACT

INTRODUCTION: Combination syndrome is characterized mainly by anterior bone atrophy of the edentulous maxilla of compressive enlargement of the area due to antagonist arch, causing an occlusal disharmony and thus, a deformity in the alveolar bone.

OBJECTIVES: The aim of the review was to investigate the causes and types of treatments available in scientific literature.

MATERIAL AND METHODS: This literature review evaluated main clinical aspects and rehabilitative treatments for combination syndrome. PubMed and Scopus databases were used with studies published until May 2021. Clinical trials, randomized and non-randomized studies, classic and comparative investigations, multicenter and in-vivo studies, case reports, longitudinal studies, and literature reviews were all included in this review.

RESULTS: Various studies have shown that anterior maxilla atrophy is the most commonly seen clinical feature; however, other features of the syndrome have not been observed in any patient. In oral rehabilitation, the use of implants mainly in the posterior region of the mandible, ensured greater occlusal balance, new bone formation in the peri-implant region, and decreased excessive compression of the anterior region of the maxilla.

CONCLUSIONS: Clinical evaluation of the causes that resulted in deformities between alveolar bones and rehabilitating these regions to offer a better distribution of forces and quality of life to patients is essential.

KEY WORDS: combination syndrome, complete denture, removable partial denture.

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INTRODUCTION

Oral rehabilitation of patients with deformities due to tooth loss is a major challenge for dental surgeon. Returning masticatory efficiency and quality of life are among the main rehabilitation goals [1]. The use of mobile prosthetic devices, such as complete denture and removable partial denture (RPD), are still indicated with

great frequency [2]. However, in some clinical situations, its' prolonged use can result in important changes in the bone contour and adjacent soft tissues [3]. Changes in occlusal architecture, occlusal instability, and changes in vertical dimension of occlusion can result in overloading of some regions of the maxillary arches [3, 4]. In cases with the edentulous maxilla and mandible with only natural anterior teeth, the overload in the anterior

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region of the maxilla is even more exacerbated; therefore, with time, bone atrophy in this region may be imminent [5].

In 1972, Ellsworth Kelly observed for the first time that there were some changes in patients who were using a complete denture maxillary opposite to mandibular anterior teeth and RPD with distal extension [5]. After monitoring these patients for 3 years, Kelly described five main clinical changes that occurred in these individuals: bone resorption in the anterior region of the maxilla, enlarged tuberosities, papillary hyperplasia in the hard palate, increased bone resorption below the bases of removable partial dentures, and extrusion of the lower anterior teeth. This set of clinical changes can be found in the literature as a combination syndrome, but they also known as ‘Kelly’s syndrome’ [5]. Later, Saunders *et al.* described more characteristics of the syndrome, including changes in the periodontium, loss of vertical dimension, poor adaptation of the prostheses, and discrepancy in the occlusion plane and anterior mandibular positioning [6].

Finding alternatives that aim to protect or even decrease the development of symptoms, such as atrophy of the alveolar bones, is a great challenge, and oral rehabilitation with dental implants may be the best indication for treatment [7]. Clinical results of the combination syndrome over time include discrepancies between arches and difficulties in establishing an ideal treatment.

OBJECTIVES

The aim of the review was to investigate the causes and types of treatments available in scientific literature.

MATERIAL AND METHODS

PubMed and Scopus databases were used for studies published until May 2021. Descriptors used for the research included: ‘combination syndrome’ OR ‘Kelly’s syndrome’ OR ‘anterior hyperfunction syndrome’ OR ‘atrophy maxillary’ AND ‘maxillary resorption’ OR ‘edentulous patient*’ OR ‘complete denture’ OR ‘removable partial denture*’ OR ‘overdenture’ OR ‘dental implant’. No exclusion criteria were used for the initial search. Clinical trials, randomized and non-randomized studies, classic and comparative investigations, multicenter and in-vivo studies, case reports, longitudinal studies, and literature reviews were all included in this review.

LITERATURE REVIEW

The focus of this review was to address the main clinical aspects of patients diagnosed with the combination syndrome. Anterior maxillary atrophy, bone resorption

with lower RPD, and possible treatment plans for these cases were addressed.

ANTERIOR ATROPHY OF THE MAXILLA: GENERAL ASPECTS AND REHABILITATION TREATMENT

Anterior maxillary hyperfunction due to excessive pressure that the lower natural anterior teeth cause, results in atrophy of the edentulous region [8]. Pal *et al.* [9] showed that this situation generates a cycle of clinical events in dental arches, which results in the extrusion of lower teeth and increase in tuberosities. Parafunctional habits, previous dental condition, such as pre-extraction bone density and intensity of occlusal forces, would determine whether this resorption would occur quickly or slowly [10].

The distance from the residual ridge and occlusal plane is a very important factor in rehabilitation planning. This could be determined according to the degree of evolution of this bone loss and would determine the most suitable type of dental prosthesis. When the distance is greater than 15 mm, removable denture are most suitable, and in patients with Kelly’s syndrome, complete denture or overdentures in dental implants are mostly recommended as they guarantee better aesthetics and support of the lips, since the acrylic base compensates for the absence of bone and gingival height [11-13]. In situations where the height of occlusal plane is less than 15 mm, implant-supported fixed prosthesis may also be indicated [12].

For rehabilitation planning in case of pre-combination syndrome, in which the patient would undergo an extraction of all the upper teeth and antagonist arch include only anterior teeth, performing this treatment initially with an implanted total prosthesis would offer better benefits for bone re-modeling, and thus less bone loss when compared to conventional technique after healing period [14, 15]. Moreover, installation of dental implants offers great results. Reverse planning for this case is of great importance, as it assesses correct position of the implants, and ensures improvements in bio-mechanics and aesthetics. Installation protocols can vary between immediate and conventional loading [12]. Both types have excellent results and high success rates in rehabilitation.

USE OF REMOVABLE PARTIAL DENTURE IN THE PREVALENCE OF COMBINATION SYNDROME: RESORPTION OF THE MAXILLARY CREST AND UNDER LOWER BASES

There are some doubts about influence of mandibular rehabilitation with RPD on the prevalence of Kelly’s syndrome. Studies have shown that bone resorption continued in patients using RPD, it was interrupted after implantation of dental implants, and bone neo-formation

was also observed [16, 17]. However, in a research of Bagga *et al.* [18] it was found that the use of lower RPD did not significantly interfere with bone resorption, with no significant differences found in groups with and without RPD; though various aspects, such as increased tuberosities, papillary hyperplasia, and periodontal diseases associated with the use of lower RPD were reported. Still, there are studies showing that the use of RPD has already well-established role in the bone resorption process, when compared to individuals who do not use it [16, 17].

Periodontal disease was reported in patients using mandibular RPD [18]. This fact is caused by the presence of bio-film in interaction with the host's auto-response causing local inflammation and later bone resorption. In the presence of a plaque retainer, as is the case with RPD, this fact can be exacerbated, and bone loss in the region of remaining anterior teeth increased [2, 8]. Therefore, the focus on oral hygiene is of great importance for the patient as well as for the success of rehabilitation [2]. A study that evaluated the evolution of bone resorption through radiographic cephalometry, with a 5-year follow-up of patients using total maxillary prosthesis, indicated several antagonists: lower anterior teeth with lower class I RPD, only mandibular natural teeth, and mandibular complete denture. It was observed that the resorption of the maxillary anterior bone was lower for the group with natural mandibular dentition [19]. As in other studies, various individual changes were noted, such as increased tuberosity and papillary hyperplasia [20]. No longitudinal study evaluating clinical changes immediately after extraction of the teeth, whether anterior superior or any other, which could characterize a patient as a possible candidate for development of the combination syndrome, has been found in the literature search.

For bone resorption on the bases of lower RPD, individuals using class I mandibular RPD presented greater posterior bone resorption than non-rehabilitated individuals [21, 22].

USE OF DENTAL IMPLANTS TO SUPPORT THE MANDIBULAR PROSTHESIS

Patients who received fixed prostheses supported by implants in the mandible had practically terminated mandibular bone resorption [17, 23]. Comparison of a group rehabilitated with mandibular overdenture on two anterior implants showed a clinical situation close to patients with natural mandibular anterior teeth [24], unlike what happened with fixed prostheses on mandibular implants that did not favor the development of greater symptoms of the syndrome [25]. Bone resorption in the anterior maxilla region was lower in individuals rehabilitated with mandibular dental implants between foramina [26].

Goiato *et al.* [12] showed high success rates in individuals rehabilitated with immediate loading implants in

partial edentulous jaws. Bone deposition, and masticatory and aesthetic improvement were observed in these patients. The mandible is more favorable for immediate loading when compared to the maxilla because the bone is more cortical. However, systemic and bio-mechanical factors, such as initial locking and angulation of the implants, must be respected. In cases where the antagonist arch is a total maxillary prosthesis, e.g., as occurs in syndromic individuals, the installation of mandibular implants with immediate loading can be a very favorable option for patients [12, 27].

The evaluated studies presented little clinical evidence about the combination syndrome, since the 5 symptomatic signs reported by Kelly were not seen in all evaluated patients. Therefore, there is no consensus on whether these clinical changes should still be considered as a true syndrome [3, 14].

DISCUSSION

The bio-mechanical factor can explain most of clinical changes presented. Natural teeth, when present, are able to functionally print maximum strength, thus increasing function and excessive bone resorption in the anterior region of the maxilla. Due to loss of anterior alveolar bone height, the entire occlusal architecture enters into re-arrangement, and the tuberosities increase in a lower direction and elevates the load expressed in distal region of the mandible, causing a resorption of the mandibular bone crest, which increase discrepancy in the occlusal plane [5]. Regardless of the discussion on the lack of consensus in the existence of the combination syndrome, clinical signs and discrepancies between dental arches continue to occur progressively. Therefore, there is a need for rehabilitation intervention based on individual anatomical, functional, and aesthetic characteristics of patients [5, 12].

The combination syndrome causes several changes in the anatomy of alveolar bone, and changes that occur in the maxilla are different from those occurring in the mandible mainly due to divergent bone quality. Moreover, bone loss is faster in initial periods after tooth extraction [14]. Jacobs *et al.* [28], through radiographic exams, evaluated bone resorption in the jaws after treatment with complete dentures, overdenture on implant, and fixed prosthesis on implant. The group that used total dentures presented greater bone loss, a fact that highlights the importance of rehabilitation planning with dental implants [28]. A study by Kordatzis *et al.* [29] showed lesser bone resorption of patients using prostheses retained by implants when compared with patients using different types of prostheses.

It is well-established that the use of implants increases quality of life of patients mainly due to improvement in masticatory strength [1, 12]. For those patients, who are candidates for developing any signs

of the combination syndrome, surgical and prosthetic planning with dental implants has the ability to improve the distribution of occlusal forces along the alveolar bone, and also aid in peri-implant bone deposition [15, 23, 28, 29]. In addition, the use of implants preserved the alveolar bone, thus culminating in less bone loss [30].

The best way to avoid or treat this syndrome is to offer a balanced occlusion with posterior dental support, preferably preserving the posterior teeth, whenever possible, in order to avoid classifying the patient for the development of clinical signs [5, 31]. Therefore, offering a balanced occlusion that does not offer contacts with excessive forces to the rim, the use of complete denture, RPD, or in association with implants, are of great importance for stabilization of clinical condition.

The material for making a prosthesis must be rigid to assist in distribution of occlusal forces, offer occlusal support for natural teeth, and present as much base coverage as possible [12]. The occlusion must be bilateral, balanced, and centered in order to guarantee stability and less stress on the edges [32].

Posterior stabilization of the mandible is the main reminder for a more precise treatment since the occlusal imbalance was the predominant factor for the development of the syndrome. The use of implants can be a great alternative, as they prevent vertical and lateral movements of the prostheses, an important factor in bone resorption, in addition to promoting posterior support, eliminating free extremities [12-15, 23, 28].

CONCLUSIONS

Understanding the reasons that led the patient to develop Kelly's syndrome is of great importance to develop a safe clinical planning based on scientific evidence. Ensuring posterior support and offering a stable occlusion without excessive occlusal loads, is the key to a correct rehabilitation treatment with removable denture or implant-supported fixed prosthesis, and thus return the patient to functional occlusion. With that, the improvement in quality of life will occur progressively.

CONFLICT OF INTEREST

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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