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Review Article

Combination Syndrome: A Systematic Review

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ABSTRACT

The group of complications which representing as a syndrome are interlinked to one another progressing in a sequential manner is known as 'combination syndrome' by Ellsworth Kelly in 1972. Combination syndrome progresses in a sequential manner.

The various features includes loss of bone from the anterior portion of the maxillary ridge, overgrowth of the tuberosities, papillary hyperplasia of the hard palatal mucosa, extrusion of mandibular anterior teeth, and loss of alveolar bone and ridge height beneath the mandibular removable partial denture bases, also called anterior hyperfunction syndrome.This is an attempt to provide an overview of combination syndrome.

Introduction

Specific oral destructive changes are often seen in patients with a maxillary complete denture and a mandibular distal extension partial denture. The group of complications which representing as a syndrome are interlinked to one another progressing in a sequential manner is known as 'combination syndrome' by Ellsworth Kelly in 1972.[1]

Definition:

The characteristic features that occur when an edentulous maxilla is opposed by natural mandibular anterior teeth,including loss of bone from the anterior portion of the maxillary ridge,overgrowth of the tuberosities,papillary hyperplasia of the hard palatal mucosa,extrusion of mandibular anterior teeth and loss of alveolar bone and ridge height beneath the mandibular partial denture bases also called anterior hyperfunction syndrome."[2]

CLINICAL FEATURES:

Kelly described five signs or symptoms that commonly occurred in this situation. They include,

1. Loss of bone from anterior part of maxillary ridge.
2. overgrowth of tuberosities
3. Papillary hyperplasia in the hard palate
4. Extrusion of lower anterior teeth
5. Loss of bone under partial denture base.[1]

Saunders *et al.*,[3] in 1979 described 6 additional changes or signs associated with this syndrome. They include,

1. Loss of vertical dimension of occlusion
2. Occlusal plane discrepancy.
3. Anterior spatial repositioning of mandible

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4. Poor adaptation of prosthesis.
5. Epulis fissuratum.
6. Periodontal changes.

Shen and Gongloff[4] investigated the prevalence of the combination syndrome in patients who use complete maxillary dentures and found the above changes most consequential to denture using occurred in 24% of patients who had natural mandibular anterior teeth opposing complete maxillary dentures.

This prevalence was five times greater than in patients who use maxillary and mandibular complete dentures. The rate did not significantly differ between patients who use or do not use a mandibular RPD.

Their study also stated that 5% of their subjects with an edentulous mandible developed combination syndrome who had even one mandibular molar present did not show the combination syndrome. This supports the opinion of Saunders et al[3] that the lack of posterior occlusal support is the key factor in the development of this phenomenon.

In 2003 a study by Palmqvist et al[5] concluded that combination syndrome does not qualify to be a medical syndrome and that there was no evidence to believe that resorption of anterior maxilla was related to the presence of natural anterior teeth in the opposing arch.

Pathogenesis

Combination syndrome progresses in a sequential manner. The progress of the disease can occur in any of the following sequences

Sequence 1

1. Patient tends to concentrate the occlusal load on the remaining natural teeth (mandibular anteriors) for proprioception. Hence there is more force acting on the anterior portion the maxillary denture.
2. This leads to an increased resorption of anterior part of the maxilla which gets replaced by flabby tissue.The occlusal plane gets tilted anteriorly upwards and posteriorly downwards.
3. The labial phalange will displace and irritate the labial vestibule leading to formation of epulis fissuratum. Posteriorly there will be a fibrous overgrowth of the tissues in the maxillary tuberosity.
4. The shift of the occlusal plane posteriorly downwards produces resorption in the mandibular distal extension denture bearing area.
5. Mandible shifts anteriorly during occlusion.
6. The vertical dimension at occlusion is decreased. The retention and stability of the denture is also reduced.
7. The tilt in the occlusal plane disoccludes the lower anteriors causing them to supraerupt. This reduces the periodontal sup.

Treatment planning:

The primary factor considered in the treatment planning of any edentulous span is the progression of residual ridge resorption. There is no uniformity in the process between sites, individuals, sexes and age groups. The main risk factors for the continuous ridge resorption both in partially and completely edentulous older subjects are the rate of previous bone loss, excessive occlusal forces during mastication and bruxism.

There are many authors who hold different opinions about the treatment procedures to prevent occurrence and further degenerative changes in the oral cavity in patients whose occlusal scheme comprise of a complete maxillary denture opposed by natural anterior teeth and a bilateral distal extension removable partial denture (RPD). Kelly said that

before proceeding with the prosthetic treatment, gross changes that have already taken place should be surgically treated. These include conditions like flabby (hyperplastic) tissues, papillary hyperplasia and enlarged tuberosities.

Kelly[7] advises reducing enlarged tuberosities to allow the lower removable partial denture to extend over the retromolar pad and buccal shelf area. Saunders et al advocate splinting the remaining mandibular anterior teeth to provide the RPD with positive occlusal support, rigidity and stability, while minimizing excessive stress on the anterior natural teeth. Therefore, prosthodontic treatment is designed to provide posterior occlusal support and to minimize occlusal pressures in the anterior maxilla. Clinical reports show that, in the absence of natural posterior tooth support, an occlusal table cannot be stabilized effectively on distal extension bases. The mucoperiosteal foundation yields under occlusal loads, rendering such sophisticated occlusal schemes palliative[4].

Treatment Option 1: Planned Extractions Followed By Immediate Dentures: This treatment option is considered when arch relationship negates an overdenture and requires an alveolectomy along with extraction of the anterior teeth for patients reporting with severe prognathic maxilla, periodontally compromised proclined anterior teeth present in the maxillary arch and missing mandibular posterior teeth (Fig 1).

The extractions of the maxillary anterior teeth were planned along with the alveolectomy in the maxillary anterior region. Hence conventional immediate denture fabrication steps were followed during primary and secondary impression making, jaw relation recording, posterior try-in and mock surgery of the casts followed by denture fabrication and insertion (Fig 2).

Figure 1 Preoperative intra oral view

Figure 2 Insertion of maxillary immediate denture and mandibular interim removable partial denture

After the mock surgery of the casts a template was fabricated by the prosthodontist in clear acrylic to help the surgeon in the surgery and guide him in removing the correct amount of tissue (Fig 3).

Figure 3 Surgical template before immediate denture placement

The main advantage in using this technique was the decrease in the resorption rate of the maxillary anterior residual ridge because ridges are subjected to early function coupled with improved aesthetics of the patient. It prevents formation of flabby tissues which could also arise as a result of unplanned or uncontrolled dental extractions[8]

Treatment Option 2: Overdenture Prosthesis with a Metallic Denture Base: Every effort should be made to avoid the potentially destructive occlusal forces exerted on the anterior maxillary residual ridge. Therefore, when a maxillary complete denture is contemplated, endodontic and periodontic techniques are used to preserve roots in order to maintain the bony architecture of the anterior maxilla (Fig 4).

Figure 4 over denture coping

At the same time, retained anterior maxillary roots will absorb occlusal forces exerted by anterior mandibular teeth. Long rooted maxillary canines strategically placed at the corners of the maxillary arch are favored. Because the abutments may act as fulcrum points after ridge resorption, fracture of a fatigued denture base

Figure1 Preoperative intra oral view

Figure 2 Insertion of maxillary immediate denture and mandibular interim removable partial denture

Figure 3 Surgical template before immediate denture placement

Figure 4 over denture coping

may occur. Cutting away or relieving the labial flange from undercut areas may render the denture base even more prone to fracture. Reinforcing the denture base with a cast metal framework has been shown to reduce fracture rates.

Treatment Option 3: Conventional prosthodontic techniques with special consideration for flabby tissues: A variety of techniques have been suggested to circumvent the difficulties of making a denture rest on flabby ridge. It has been stated that while the flabby ridge may provide poor retention for a denture, it is better than no ridge-as could occur following surgical excision of the flabby tissues suggested in the past to help record a suitable impression of a flabby denture-bearing area [8]. The maxillary impression is made in a specially designed tray using a combination of green stick compound border molding and zinc oxide eugenol impression paste along with impression plaster without distorting the anterior residual ridge and the flabby tissue (Fig tissue in the anterior region

Elastomeric impression material can be used instead of green stick compound and zinc oxide eugenol impression paste for making the secondary impression.

Treatment Option 4: Surgical Intervention (Vestibuloplasty and Excision of Flabby Tissue) Followed by Metallic Denture Base Prosthesis: Patients reporting with a completely edentulous maxillary arch opposing anterior natural dentition in the mandibular arch along with destructive changes in the hard and soft tissues of the jaws of the combination syndrome such as severe anterior ridge resorption, epulis fissuratum and flabby tissue in the maxillary arch accompanied by loss of vertical dimension require surgical intervention (Fig 6).

Vestibuloplasty and excision of flabby tissue was planned. Impression of the maxillary arch was made followed by a mock surgery on the cast obtained. A heat cured surgical template is fabricated on this cast as which is to be screwed in situ for 3 weeks for the tissues to heal to an adequate vestibular depth after vestibuloplasty, soft tissue contouring of the maxillary

Figure 5 Special Impression Technique for flabby

Figure 6 Epulis fissuratum and flabby tissue present in the maxilla

Figure 7 Surgical template screwed to the palate for 3 weeks after vestibuloplasty and excision of flabby tissue

ridge and excision of the flabby tissues and hyperplastic tuberosities(Fig 7).

Figure 6 Epulis fissuratum and flabby tissue present in the maxillary anterior region

After 3 weeks the surgical template is removed and the tissues allowed healing for another 3 weeks.

Figure 7 Surgical template screwed to the palate for 3 weeks after vestibuloplasty and excision of flabby tissue

Following this conventional procedures are followed to fabricate a maxillary complete denture and a mandibular distal extension cast partial denture.

After ridge resorption, fracture of a fatigued denture base occurs along with cutting away of the labial flange from undercut areas during function. This renders the denture base even more prone to fracture.

Figure 8 Maxillary prosthesis with metallic denture base and mandibular distal extension cast partial denture

Figure 9 Metallic denture base for the maxillary prosthesis

Patients reporting with a history of a previous denture with a similar fracture pattern, require the maxillary denture base to be reinforced with a cast metal framework. This has been shown to reduce fracture rates (Fig 8 & Fig 9).

The occlusal scheme given to this patient consists of maximum occlusal support posteriorly with no anterior contacts in centric occlusion. balanced articulation in eccentric movements, in order to further reduce pressure on the anterior maxillary ridge.

Figure 8 Maxillary prosthesis with metallic denture base and mandibular distal extension cast partial denture .

Figure 9 Metallic denture base for the maxillary prosthesis.

Treatment Option 5: Implant Placements: Four options can be used in rehabilitating a completely edentulous maxilla using implants like implant supported fixed ceramo-metal prosthesis with gingival ceramic, implant supported fixed ceramo-metal

prosthesis, Implant supported overdenture or an implant and tissue supported overdenture [9].

Treatment planning for the Distal extension partially edentulous Mandibular Arch. The main aim of prosthetic therapy is to restore stable occlusion with good facial height. The main risk factors to consider in the partial edentulous patients are associated with the progression of periodontal disease, caries activity, residual ridge resorption and functional problems. It is often possible to stop progression of periodontal disease in the elderly with conservative and surgical periodontal therapy; and by instituting adequate hygiene measures. In this way stable periodontal conditions can normally be established, which are essential for an acceptable long term prognosis of reconstructive prosthodontic therapy. Different treatment approaches have been advocated for the low-risk patients who have not yet developed the combination syndrome and with well preserved mandibular anterior teeth and the high-risk patients with destructive changes or supraerupted or periodontally involved mandibular anterior teeth. The spatial position of the mandibular anterior teeth is important to the treatment plan.

Treatment Option 1: Overdenture: Teeth that are considerably supraerupted would require alteration by shortening, crowning or placing them under an overdenture to obtain a harmonious occlusion. The spatial position of the mandibular anterior teeth is important to the treatment plan. The level of the incisal edges of the mandibular anterior teeth should be assessed in comparison to the proposed posterior occlusal plane.

Treatment Option 2: A Removable Cast Partial Denture: Mouth preparation is done to support a removable cast partial denture with an occlusal plane conducive to a bilateral balanced articulation. The lingual plate delays the over eruption of the mandibular teeth, preventing undesirable anterior pressure on the anterior part of the maxillary denture. Optimum fit of the denture base of the removable cast partial denture is achieved using the altered cast technique. Posterior occlusal contact must be maintained by constant relining. extension denture base to compensate for its resorption.

Treatment Option 3: Implant Supported Fixed Prosthesis: In Distal extension partially edentulous situations implant supported fixed prosthesis may be used in case there is adequate bone height and width, no anatomic structures that could interfere with implant placement and visual inspection and palpation do not show presence of any flabby excess tissue, bony ridges and sharp underlying osseous formations or undercuts.

DISCUSSION

*Dorland's Illustrated Medical Dictionary*51 defines "syndrome" as "a set of symptoms which occur together; the sum of signs of any morbid state; a symptom complex." "Combination syndrome" is not included among hundreds of syndromes listed in the dictionary. "combination syndrome" does not meet the criteria to be included in such a list. In a review of the literature, the authors have found no epidemiologic study of "combination syndrome." Compared with the main feature,"loss of bone from the anterior portion of the edentulous maxilla," findings such as "papillary hyperplasia of the hard palatal mucosa" seem to be rare.[10,11] Enlarged tuberosities may also have other causes than those described by Kelly2 as part of the combination syndrome.Enlarged tuberosities are often seen together with supraerupted maxillary molars. In situations where mandibular molars have been lost, the

opposing maxillary molars may supraerupt together with the alveolar process[12].

The supraeruption may create enlarged tuberosities without influence of a denture.

Not surprisingly, no randomized controlled trials (RCTs) on combination syndrome were found. A review of U.S. prosthodontic journals showed that less than 2% of 3631 articles published over a 10-year period could be classified as RCTs.[14]A more extensive review up to the end of year 2000 identified 92 RCTs in prosthodontics, but none related to combination syndrome.[13] Perhaps somewhat more surprising, is that there seems to be no prospective study of the "combination syndrome" in spite of the fact that many people have been provided with a complete maxillary denture opposed by anterior mandibular teeth with or without a Class I mandibular RPD. A long-term 21-year study of patients wearing complete maxillary dentures provided no support for a systematic development of the "combination syndrome." This does not mean that the observations made by Kelly were false. In the title of his article, he emphasized the negative role of the mandibular RPD. The same view was expressed by Keltjens et al,[15] who found the traditional treatment for an edentulous maxilla opposed by a partially edentulous mandible with a complete denture and a Class I mandibular RPD to be "fundamentally inadequate." The authors alsosuggested use of implants for distal support.

Loss of established posterior occlusal contacts has been discussed as an important factor in relation to the combination syndrome.[4] However, loss of occlusal contacts can be attributed not only to bone resorption under mandibular distal extension bases but also to wear of the artificial denture teeth, as well as to changes in position of the anterior mandibular teeth. It can be speculated that such changes in occlusion facilitate parafunctional activities such as clenching and thereby increase the pressure on the maxillary anterior alveolar bone.

This speculative theory fits well with the result that patients who had been provided with Class I mandibular RPDs had development of more signs and symptoms of temporomandibular disorders over a 5-year period compared with a matched group of patients treated with cantilevered fixed partial dentures.[16] It is also compatible with results from in vivo measurements showing that From this review of the literature it seems obvious that a fixed implant-supported prosthesis in the mandible opposing a complete maxillary denture improved the "chewing ability" but did not increase the levels of loads transferred to the denture base.17

Loss of alveolar bone and residual ridge height beneath the mandibular removable partial denture bases was included in the combination syndrome by Kelly.

Reviewed articles have shown greater bone loss in the mandible associated with an RPD compared with when no RPD or a fixed prostheses supported by anterior implants was provided.[18,19,20,21,22] Compared with cantilevered fixed partial dentures, conventional Class I mandibular RPDs have been shown to cause more carious lesions, more plaque and gingivitis, as well as more signs and symptoms of temporomandibular disorders. 56,57

The poor biologic outcome with Class I mandibular RPDs constitutes a strong indirect support for the "shortened dental arch" concept,[23,24] indicating that missing posterior teeth should not necessarily be replaced.

It has been convincingly demonstrated that dentitions

consisting of only anterior and premolar teeth can meet oral functional demands in most situations. [25,26] Also in patients with dentitions associated with the combination syndrome (edentulous maxilla, bilaterally missing mandibular posterior teeth) it seems reasonable to adopt the shortened dental arch concept. This view is also in agreement with the well-documented excellent long-term results with fixed mandibular prostheses supported by implants placed between the mental foramina and opposing maxillary complete dentures.

Summary

Resorption of bone in the anterior part of the edentulous maxilla when opposed by remaining anterior mandibular teeth has been a subject of a limited number of studies of acceptable quality, but the result have not been conclusive. No epidemiologic study of the various features related to combination syndrome has been published. There is no evidence that a mandibular removable partial denture can prevent the development of the events described.

On the basis on this review of literature it may therefore be concluded that the "combination syndrome" does not meet the criteria to be accepted as medical syndrome. The single feature associated with the "combination syndrome" exist but the extent or in which combinations has not been clarified

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