Original Article

Clinical assessment of the overdenture therapy

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A study was conducted to evaluate the clinical performance of tooth supported overdentures vis a vis. Conventional dentures. Forty two telescopic overdentures were constructed for thirty seven patients selected amongst the serving and retired defense personnel and their families. Most of such appliances constructed were lower complete overdentures. A general evaluation of this treatment modality was made against the conventional dentures routinely being provided simultaneously to other comparable cases. The results showed much better denture stability, improved retention, better patient acceptance, higher chewing performance, lesser post insertion sore spots, grossly reduced alveolar bone loss and shorter adjustment period in subjects provided with overdentures as compared to those provided with conventional dentures. The technique, though time consuming, was simple enough for execution in peripheral dental establishments having facilities for small castings. The overdenture therapy was found to be eminently suitable and rewarding for treating patients for whom full lower extractions and conventional complete dentures are planned.

Key words: Overdenture, tooth supported overdenture, telescoped dentures, crown and sleeve dentures, overlay dentures

INTRODUCTION

An overdenture is a removable prosthesis either complete or partial, whose denture base covers one or more natural teeth, or tooth roots.[1,8] Various terms have been used to describe this treatment modality: overlay denture, telescoped dentures, tooth supported dentures, hybrid prosthesis, crown and sleeve prosthesis, and the superimposing dentures.[1]

Overdenture therapy envisages essentially a preventive prosthodontic concept since it attempts to conserve the few remaining natural teeth. There are two physiologic tenets related to this therapy: the first concerns the continued preservation of alveolar bone around the retained teeth[10] while the second relates to the continuing presence of periodontal sensory mechanisms[11] that guide and monitor gnathodynamic functions.

Overdentures help to partly overcome many of the problems posed by conventional complete dentures like progressive bone loss, poor stability and retention, loss of periodontal proprioception, low masticatory efficiency, etc.[2]

In telescopic overdentures,[3] the selected abutment teeth are subjected to periodontal and endodontic therapy and covered with medium (4-5 mm) occlusally converging primary cast copings.[1] Support and frictional retention for the prosthesis is provided either by secondary cast copings fitting over the primary copings and incorporated as an integral part of the denture base or by processing the dentures base resin directly over the primary copings cemented onto the abutments. The telescoping between metallic copings directly with acrylic channels in the denture base has its own merits.

Review of literature

The concept of overdentures dates back to well over a century. Henking[1] stated that Ledger and Atkinson advocated leaving 'Stumps' under artificial dentures for support.

Reitz *et al*[2] mentioned that J. B. Beers patented a telescopic crown in 1873. Schweitzer *et al*[3] reported that the 1887 ed. of American text-book of dentistry and F. A. Peeso described removable telescopic bridgework.

Augsburger[4] cited Hall and Gilmore who described bar splinted abutment teeth for supporting denture work. The Gilmore attachment paved the way for attachment supported over dentures.

Prothero[5] described prosthetic devices retained by telescopic crowns, bars and screws, Brill[6] reported on overdentures and termed the appliance as hybrid

prosthesis.

According to Korenhof,[7] Dolder's work in the 1950's popularised the bar and clip retained overdentures.

Miller[8] revived interest in the telescopic overdentures. He advocated primary gold copings over reduced abutment teeth and secondary individual gold copings under the denture base. He opposed the concept of splinted abutments because of hygiene problems.

Berman and Lustig[9] described the role of telescopic units in oral reconstruction. Prince[10] reported internal clip retained overdentures.

Yalisove[11] described crown and sleeve coping retainers for overdentures. The telescopic units consisted of long dome-shaped primary gold copings over multiple abutments and a set of secondary cast copings attached to the overdenture. The secondary copings had a milled-in relief to cater for stress reduction.

Prieskal[12] described various commercially available overdenture attachments and in 1968[13] described a composite impression technic for overdentures.

Lord and Teel[14] advocated fairly short rounded primary copings and no metal inserts for the overdenture. Isaacson[15] reported overdentures construction using preformed springed attachments. Prieskel[16] descirbed screw retained telescopic bridges. Kabcennel[17] described the use of Ceka overdenture attachment.

Brewer and Fenton[18] advocated short dome-shaped reduction of endodontically treated abutments followed by amalgam fillings and construction of overdentures with no castings.

Mensor[19] classified described various prefabricated overdenture attachments.

Merrow *et al*[20] and Fenton[21] described the construction of immediate interim overdentures.

In a two year study of overdenture patients, Toolson and Smith[22] reported high caries susceptibility of uncovered abutment teeth which was significantly reduced by flouride applications.

Ebel[23] questioned the widespread use of stud type overdenture attachments over periodontally weakened teeth. According to him, engagement of undercuts by soft liners can minimise the need for overdenture attachments.

Ghalichebaf[24] described cosmetic overdentures. Moghadam[25] reported magnetically retained overdentures.

Rationale of overdenture therapy

The physiological basis of overdenture therapy lies in the continued retention of reduced natural teeth under the denture base. The abutment teeth so retained apart from supporting and anchoring the appliance, contribute towards continued preservation of alveolar bone and periodontal proprioception.

Progressive and rapid bone loss following removal of teeth leading to constantly shrinking alveolar ridges has ever been an enigma for the dental profession. Dentists also observed that alveolar bone was maintained around standing teeth and retained roots.

Miller[8] advocated retention of teeth as a means of alveolar ridge preservation.

Tallgren[26,27] in longitudnal cephalometric studies of complete denture wearers reported that alveolar bone loss was progressive, the los being four times more in the lower arch compared to the upper. The mandible showed loss of appx 10 mm in ridge height over a period of 25 years, the reduction in the maxillary ridge height during the same period being 2.5-3 mm.

Atwood[28] observed that the residual ridge resorption (RRR) after tooth loss was chronic, progressive, cumulative, irreversible and perhaps inevitable.

Loiselle *et al*[29] reported that in patients wearing complete lower overdenture, there was no discernible change in the anterior alveolar ridge height over a period of two years.

Lam[30] showed that natural and artificial root implants drastically reduced the resorption of the alveolar bone. Guyer[31] reoported that submerged roots effectively maintained the alveolar ridges.

Crum and Rooney[32] in a five year study of patients wearing overdentures and conventional dentures reported that the vertical alveolar bone loss in the anterior region under complete mandibular overdentures supported by canine abutments and opposed by complete conventional dentures was only 0.6 mm after 5 years. In the case of conventional lower dentures, the loss averaged 5.2 mm.

Manly[33] reported that the oral mucosa had considerable less perception and proprioceptive abilities as compared to the pdl receptors.

Tryde *et al*[34] reported that while the minimal dimensional perception threshold for natural teeth was appx 20 microns, the same for mucosa borne dentures was 60 microns.

Posselt[35] stated that the motor performance was programmed and monitored by the sensory feedback from oral receptors. The periodontal proprioception was mainly responsible for precise closure into the intercuspal position.

Crum and Loiselle[36] reviewed subject of oral perception and proprioception and concluded that periodontal receptors had and important role in the overall neurologic mechanisms controlling and monitoring the jaw function.

Dodge[37] believed that the periodontal sense under overdentures helped skilful manipulation of the appliance and precision in jaw movements.

Pacer *et al*[38] reported that overdenture patients could discriminate loads over 2000 gms better than conven-

tional complete denture patients.

Levin[39] in studies involving natural dentitions, overdentures and complete dentures showed that dimensional perception was most acute in patients with natural dentitions followed by those wearing overdentures and least in case of complete denture patients.

Nagasawa *et al*[40] from emg studies of patients wearing complete conventional and overdentures concluded that the periodontal proprioception influenced the efficiency and the skill in the cyclic jaw movements.

Renner *et al*[41] stated that the retained roots of anterior teeth under the overdenture helped prevent the sequalae of 'anterior hyperfunction syndrome', an all too common problem associated with conventional complete dentures.

MATERIALS AND METHODS

42 overdentures were constructed for 37 patients aged 30 to 73 years, comprising of 22 males and 15 females, selected amongst the serving and retired armed forces personnel and their families. The prosthesis provided included 30 complete lower overdentures, 7 complete upper overdentures and 5 partial overdentures (including one for cleft palate patient).

Patients were selected depending on following criteria: good general health; healthy oral mucosa; normal jaw movements, no TMJ disorder, acceptable jaw relations, availability of adequate denture space, and suitable abutment teeth, good oral hygiene, no previous denture experience, co-operative attitude and motivation.

Abutments were selected after clinical assessment and review of study casts and radiographs. Following factors were considered: relative axial inclinations, periodontal status as revealed by mobility, pocket depth, gingival contours, gingival recession etc, crown root ratio and root morphology, nature of alveolar support, location in arch, caries involvement endodontic considerations.

Ideally sound teeth in good periodontal health were sought. Teeth with gross coronal or root caries, markedly unfavorable axial inclination, poor crown/root ratio with less that 7 mm bone support and those with mobility over grade 2 were avoided.

Abutment modifications

Teeth other than those selected as abutments were extracted and a healing period of 8-12 weeks allowed. During this interval abutments were suitably modified and subjected to periodontal and endodontic proceedings.

Abutments were prepared to a height of 4-5 mm occluso-gingivally with a uniform taper of 3-5 degree and apical chamfer at dento-gingival junction. A 3 mm cylindrical channel with antirotation extension prepared in pulp canal developed the space for short dowels cast as a part of the metallic copings. This greatly enhanced retention of copings.

This impressions were made using regular body sillicon impression material and poured in die-stone. Copings were cast using standard technique. These were cast either using a Nickel - Chromium alloy (REMANIUM-G SOFT DENTAURM) or a silver- palladium alloy (T-III LITE HOWMEDICA, USA) Finished copings were cemented using glass ionomer cement (Fuji 1, GC Corp).

In favourable cases with strong abutments, good axial inclinations and adequate space availability, secondary copings were cast over the primary finished copings to become the integral part of the acrylic denture base subsequently.

Denture fabrication

The procedure of making dentures was similar to that used for the making of conventional acrylic dentures. High impact acrylic resin (LUCTIONE-199) was used for the purpose of making overdentures, when secondary cast copings were used the impressions were made after fixing them over the primary copings with copalite varnish. When secondary cast copings were not used, the acrylic sleeves in the denture base and the primary copings fixed onto the abutments supported and stabilized the acrylic dentures.

Denture insertion

Slight errors of alignment between the covered abutment teeth and corresponding Telescopic acrylic sleeve occurred due to polymerization shrinkage. The acrylic sleeves were slightly enlarged with suitable carbide bur to allow easy insertion of the overdenture.

Usual adjustments for proper fit, border extensions and occlusion were made. Self-curing acrylic resin in flowing consistency was then used to reline the sleeves taking usual precautions. When secondary metallic copings were used, these become embedded in acrylic base at this stage.

Post insertion protocol

The patients were given the usual home care instructions about wearing and care of dentures. The importance of maintaining the health of retained teetjh was stressed upon, since all the advantage of overdentures solely depended upon their continued presence. Gentle cleaning and massage with soft tooth brush using fluoride tooth paste, frequent use of mouth washes, removal of denture at night and meticulous denture

hygiene with denture brush and mild soap etc. were explained. Recall visits schedule followed was: after 24 hrs, 2 weekly visits, to fortnightly visits and thereafter every six months. In addition, the patients were free to visit the clinic any time in case of any problem.

At recall visits, the oral health status was monitored. Dentures were assessed for retention and stability and occlusion was refined. Passivity of contact between denture and gingival area of the abutments was assessed. The overdentures were also assessed against conventional dentures provided to other comparable subjects.

RESULTS

1. The preparatory phase for overdenture patients was protracted as compared to that for conventional denture patients. [Figures 1-5]
2. The alveolar bone was well maintained around the abutment teeth under the overdentures throughout the observation periods of upto 3 years.
3. The superior stability and retention of the overdenture was apparent from the insertion phase itself. Of the 30 lower complete overdentures, the stability and retention was rated good for 17, satisfactory for 12, and poor for 1 prothesis. For the 30 lower conventional complete dentures, the corresponding values in the above categories were 6, 11 and 13 respectively.
4. Patients wearing complete overdentures got accustomed to their appliances in an appreciably shorter span of period as compared to those wearing conventional complete dentures.
5. Patients with overdentures reported fewer incidences of sore spots in relation to prosthesis.
6. Out of 145 abutment teeth under 42 overdentures, a total of 21 teeth were lost during study, the period of loss varying from 4-22 months post insertion. 13 abutment teeth were lost due to periodontal breakdown and 2 were lost due to endodontic failure. For the 6 teeth, the cause was uncertain as they were extracted by other dentist.
7. Of the 110 abutment teeth covered with copings, only 4 developed root caries following gingival recession over a period of time.
8. Out of 37 complete overdentures, no case of denture fracture occurred during the period of observation.

Figure 1: Well preserved ridge under overdenture : 1 yr post operative

Figure 2: Overdenture supported by prefabricated posts

Figure 3: Amalgam restorations to enhance wear resistance

Figure 4: Partial upper denture in cleft lip case

Figure 5: God gingival health with overdenture 9 months post insertion

9. After a lapse of 6 weeks from the time of insertion, the masticatory efficiency was evaluated based upon patient's subjective judgment, questioning by the dentist regarding the nature of food and eating habits of the patients and the ability to chew roasted groundnuts one by one. Of the 32 overdenture patients, 19 were rated as good, 11 as satisfactory and 1 as poor as compared to conventional denture patient for whom the corresponding values were 8, 14 and 10 respectively.
10. Out of 30 lower overdentures, none required relining upto 1 year. In the second year 3 cases were considered as candidates for relining. For the 30 conventional lower denture patients, 3 required relining after 6 months and 6 others had to be relined after 1 year.

DISCUSSION

Overdenture therapy constitutes essentially a preventive prosthodontic concept as it endeavors to preserve the few remaining teeth and the supporting structures.[1,2,4,8] The teeth which are too weak to support a fixed partial denture and are considered unsuitable to support a removable partial denture can oftentimes be usefully conserved and suitably modified to act as abutments under overdentures for useful span of time.

The overdenture theory and practice is based on rational principles and the procedures involved have been standardized and simplified to such an extent that this modality of treatment should be considered for virtually every patient for whom full mouth extractions have been planned.

It is a documented fact that after the loss of the teeth the residual alveolar ridge undergoes rapid loss in all dimensions. The phenominon of residual resorption (RRR) following removal of teeth been well observed and documented in literature.[22,26] While the bone loss following the removal of teeth is stated to be rapid, progressive, irreversible and inevitable, it is equally well observed that bone is maintained around standing teeth and implants. The residual ridge is faster and more marked in lower arch.[26,27]

It is thus imperative that we endeavor to maintain a suitable complement of so called 'terminal dentition' in order to preserve the alveolar bone. The rational measures to preserve such retained teeth concentrate on improving their periodontal status which includes reducing mobility, improving crown: root ratio and minimizing leverage and horizontal stress concentration.

It, however, can't be overemphasised that good principles of complete denture construction must be followed in letter and spirit to achieve optimum results from the overdenture therapy.

As the overdenture status of the prosthesis and its benefits to the patient depend solely on the continued retention of the underlying abutments, it becomes obligatory to periodically monitor their health and institute necessary steps to prolong their useful span. Herein lies the importance of periodical recall and review and patient motivation which makes overdenture therapy a continued service.

The retention of some abutment teeth under the overdenture keeps intact the associated peridontal structures and thus a limited ability to sensory input into the CNS at the perceptive and proprioceptive levels,[37] such input being an integral component of overall engrams controlling jaw function.[36] Anterior teeth are more sensitive compared to posteriors and can perceive much smaller tactile and pressure stimuli. The canines are stated to be the most richly innervated and sensitive amongst all teeth and thus become the preferred abutment teeth under overdentures. Also due to their long triangular roots they are retained in the system for longer duration.

CONCLUSIONS

The following conclusions can be drawn from this study:

1. Overdenture treatment helps preserve alveolar bone around abutment teeth and also in adjoining areas due to lowering of compressive stresses.
2. Overdenture patients require less frequent relining of denture base.
3. Overdentures are more stable and functionally more retentive.
4. Incidence of sore spots is less under overdentures.
5. Compared to conventional denture therapy, this mode of treatment takes longer time to fabricate.
6. Patient satisfaction and acceptance of the overdenture treatment modality is superior when compare to conventional dentures.

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