

Analysis of Abutment Teeth in Partially Edentulous Patients

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ABSTRACT

The aim of the study was to examine changes in the position of the abutment teeth (AT), size of undercuts for a denture clasp, as well as an existence of an adequate preparation of abutment teeth. A total of 156 casts of partially edentulous jaws, with 460 AT, were analyzed. The size of undercuts, a degree of abutment rotation, inclination and migration were measured using a dental parallelometer. The abutment teeth position was related to the level of occlusal plane in a dental articulator. Furthermore, the existence of an adequate preparation of abutment teeth, as well as a type of a denture and a type of a denture retention element were also considered. Analysis were carried out twice on casts made from a hard stone, the first time before the denture treatment had begun and the second time on the new casts obtained after new dentures had been delivered. The first analysis (prior dental treatment) revealed that a total of 33.9% of the analyzed AT were rotated, 31.3% were inclined, 12.1% had migrated, and 57.3% were elongated above the occlusal plane. On the casts obtained after the new dentures had been made, it was observed that none of the AT had an adequate preparation. Only 37.6% of all retention elements were located in adequate undercut positions on the AT. Upon the results of the present study a conclusion can be established that many abutment teeth are rotated, elongated, inclined, and migrated, which point to a requirement for AT preparation prior the manufacture of new denture; however none of the AT was adequately prepared considering insertion plane and many denture elements were located in an inadequate undercut size.

Key words: partial denture, abutment teeth position

Introduction

Partial edentulism is a condition characterized by loss of some permanent teeth in the upper and/or lower dental arch¹. Such condition can influence someone's general health, as well as nutritional, social and even cognitive status². A large number of lost teeth can influence general health in terms of inadequate nutrition and consequent decrease of body mass index. Social and psychological disturbances and embarrassment are caused by unsatisfactory teeth appearance and problems with chewing, talking, smiling and/or kissing.

Among other options, partial edentulism is most frequently treated with different types of partial dentures. The most frequently manufactured partial dentures are immediate mucosa supported removable partial denture with wire clasps (WC-RPD) and tooth and mucosa sup-

ported cast removable partial denture (metal cast removable partial denture (MC-RPD)). The MC-RPD are considered to have more functional, esthetic, and preventive values than WC-RPD. Indications for different types of removable dentures depend on biological values of patients remaining teeth, their position, and however on patients finances, which sometimes exclude implant fixed partial denture therapy.

Teeth adjacent to edentulous area can incline, migrate, rotate and elongate, depending of the duration of partial edentulism, the quality of a tooth supporting tissues, oral habits, occlusal force direction, etc. Inclination is leaning of the tooth-mesially, distally, vestibulary or orally in relation to the occlusal plane. Rotation is revolving of the tooth around its axis. Migration is a change of a

tooth position in a horizontal plane in any direction. Tooth elongation is a vertical movement above the occlusal plane¹.

Abutment teeth (AT) must be prepared for the receipt of denture elements including guiding planes for denture insertion, as well as occlusal rest seats and denture clasps.

The objective of this study was to measure a degree of rotation, migration, inclination, and elongation of abutment teeth before the treatment, as well as to examine AT preparation after partial removable denture delivery.

Materials and Methods

Materials

A total of 156 study-casts (with 460 AT) of partially edentulous jaws were analyzed. Alginate impressions (Tropicalgin, Zhermack, Italy) were obtained from the patients before the denture treatment had begun and the casts were poured from the hard stone (Elite model, Zhermack, Italy). Each cast was analyzed in the Degusa SA parallelometer (Germany), and in the semi-adjustable articulator Artex, Girbach, Austria. The second casts were obtained likewise from the same patients after the denture had been delivered to the patient.

Patient's data, Kennedy classification, number of AT and a type of delivered dentures were also recorded. Elongation or infraocclusion of AT in relation to the occlusal plane were measured in the articulator. The rotation, migration and inclination of the same teeth were evaluated in the parallelometer. The casts were studied in the »zero« position. Rulers with the precision of 0.25 mm were used during all measurements.

Elongation or infraocclusion of teeth was measured in relation to the plane where wax rims contacted. In cases of a stabile intercuspation, elongation and infraocclusion were measured in relation to the existing occlusal plane. Rotation was measured as a horizontal distance between the central fissure, or incisal edge, and the centre of the alveolar ridge.

The second phase of analysis included casts obtained after the denture had been delivered, with the measurement of the size of the undercuts where the tip of the

denture clasp was located. The undercuts were measured in the dental parallelometer, after the analyzer had been parallelized to the path of insertion of the denture, using suitable instruments with radius varying from 0.25 to 3.5 mm.

Statistics

Statistical analysis was made using the software SPSS for Windows 17 (Chicago, Illinois, USA). It comprised methods of descriptive statistics (mean values, percentages).

Results

Majority of the examined casts were Kennedy I and Kennedy I/1 classification (38.4%, and 23.0%, respectively). Each cast had two or four AT (41.0% and 30.7%). In the most of the cases, AT were canines (29.5%), followed by the first and the second premolars (20.0%, and 15.6%).

A total of 264 AT were elongated (57.3%). The elongation up to 2 mm was the most frequent. Only 15.6% of the AT were in infraocclusal position, mostly for the amount of 0.5–1.0 mm (12.1% of the AT) (Figure 1). Figure 1 shows percentages and exact amount of AT elongations or infraocclusal positions.

Abutment teeth rotation was observed in 33.9% (Figure 2). A total of 18.2% of AT rotated towards vestibulum, mostly for 1–2 mm, whereas 15.6% rotated orally.

Migration of AT was observed in 12.1% cases; 8.6% migrated towards the edentulous area for the amount of 0.75–1 mm.

Inclination was found in 31.3% of the AT, mostly towards the edentulous area (13.9%), but also towards vestibulum or towards oral cavity (8.6%, and 7.8%). Figure 2 represents percentages of rotated, inclined and migrated teeth, as well as the most frequent directions of AT movement.

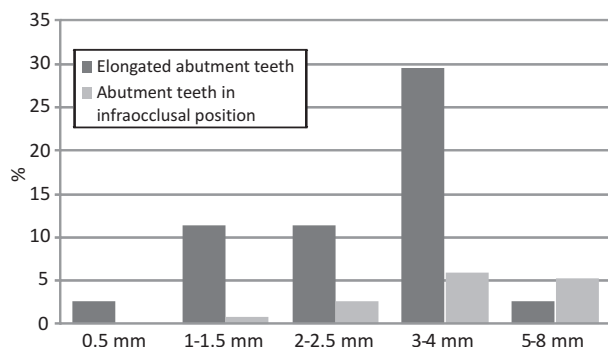


Fig. 1. Percentages of elongated abutment teeth and abutment teeth in infraocclusal position.

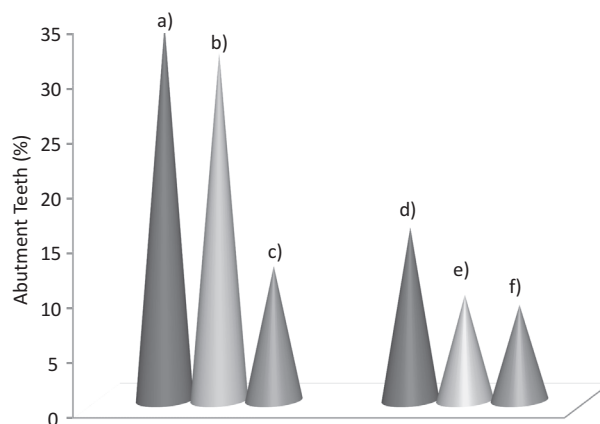


Fig. 2. Abutment teeth rotation, inclination and migration: a) rotated AT b) inclined AT c) migrated AT d) AT rotated vestibularly for the amount of 1–2 mm e) AT inclined towards edentulous area for amount of 0.5–1 mm f) AT migrated towards edentulous area for the amount of 0.75–1 mm.

The MC-RPD was manufactured in 43.5% of the cases, and the WC-RPD in 54.4% of the cases. Among surveyed denture retention elements of the MC-RPDs, three types of metal clasps were recorded: Bar clasps (45.0%), Ring clasps (18.3%), and Back-action clasps (23.3%). Moreover, 10.0% of the AT on casts with the MC-RPDs did not carry a retention element. Further, all WC-RPD were retained by a Wrought Wire clasp or a wire Bar clasp (56.3% and 43.1%). A total of 48 AT (20.0%) in a group with MC-RPD had the occlusal rest seat preparations. Properly prepared guiding plane, without other elements of preparation, was found in 12 AT (5.0%). Four teeth bared both, occlusal rest seat and the undercut formed using composite material (1.6%). A total of 26.6% AT of MC-RPD had at least a preparation for one element, but none of the AT had preparations for all necessary denture elements. A total of 128 AT had no signs of pretreatment preparation (73.3%). The tips of metal Bar clasps were located in adequate undercut size in only 40 AT (37.0% of all metal Bar clasps), whereas the Ring clasps were positioned in an optimal undercut size only on four teeth (7.1% of all Ring clasps). In addition, no Back-action clasps were found in a suitable undercut size. All together, only 44 clasps of the MC-RPD group were located in an adequate undercut size (20.3%). In the WC-RPD group, 58.8% wire Bar Clasps and 41.6% Wrought Wire clasps were positioned in the satisfactory undercut size. Additionally, 39.8% wire clasps were located in 0 mm undercut size. Among all retention elements of both groups a total of 37.6% retention elements were positioned in an acceptable undercut size.

Discussion

Most clinical methods for evaluation of AT position use a special jig for measurement of the angle between the tooth axis and the occlusal plane⁷. Some researchers used personal computers to analyse AT position in a dental arch in comparison to an optimal tooth position^{8,9}. Moreover, some studies used X-rays to measure the angle between the tooth axis and the Mandibular Plane¹⁰. The AT inclination towards the edentulous area can be estimated relatively to other teeth and the occlusal plane¹¹.

Many studies analysed AT position on laboratory casts poured in the hard stone, or combined laboratory and clinical methods¹². Laboratory surveys use study-casts, dental parallelometers and articulators, which offered a

more spacious working area compared to a direct oral measurements and therefore such method was used in the present study. One study revealed a correlation of 89.0% between clinical and laboratory methods¹².

Results of this study showed that the AT elongation was the most frequent AT displacement, followed by the rotation and the inclination, while the migration has been less commonly observed. This result can be explained by a frequent absence of the opposing teeth¹³. The most frequent amount of AT elongation, was only for the amount of 1–2 mm. It can be explained by a lack of antagonistic teeth for relatively a short period of time or by other occlusal contacts during eccentric movements, which prevented further elongation.

Inclinations and rotations of AT towards the edentulous area were most frequently found and were attributed to the horizontal forces and the absence of interdental contact points between teeth which prevent harmful action of horizontal forces¹.

The low percentage of adequately prepared AT for the elements of MC-RPD, as observed in this study, was not as expected. Clasps of MC-RPDs placed in inadequate undercuts suffer larger forces, and more often break. Moreover, inadequately prepared AT may be subjected to extensive or inadequate forces and may suffer from periodontal problems. Additionally, it is known that repairment of metal cast clasps is complex and expensive, resulting in their replacement with wire clasps, which further decrease the quality of a MC-RPD. The occlusal rest seat preparation was observed in only 20.0% of AT and many retention elements were located in an inadequate undercut size. It can be assumed that inadequately prepared AT can lead to different technical and biological complications during the prospective longitudinal follow up clinical observation which can further lead to reduced patient's satisfaction with chewing ability, aesthetics and oral health related quality of life^{14–26}.

Conclusions

Removable denture abutment teeth were often elongated, rotated and inclined. Less often AT migrated. A significant number of denture retention elements were located in an inadequate undercut size. Abutment teeth were generally not adequately prepared for the receipt of elements of a partial denture.

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ANALIZA ZUBA NOSAČA U DJELOMIČNO BEZUBIH PACIJENATA

S A Ž E T A K

Cilj istraživanja bio je ispitati promjene položaja zuba nosača predviđenih za prihvaćanje određenih elemenata djelomične proteze, izmjeriti veličinu podminiranih mjesta za kvačice, kao i evaluirati postojanje adekvatne pripreme zuba nosača. Analizirano je ukupno 156 modela djelomično bezubih čeljusti, s ukupno 460 zuba nosača. Pomoću zubnog paralelometra i dentalnog artikulatora izmjereni su slijedeći parametri: veličina podminiranih mjesta zuba nosača, stupanj rotacije, nagib i pomak zuba. Položaj zuba nosača mjeren je ovisno o njegovom odnosu prema okluzijskoj ravlini u artikulatoru. Analizirani su i postojanje odgovarajuće pripreme zuba nosača, kao i vrsta djelomične proteze koja je izrađena, te vrsta elementa za retenciju proteze. Analize su učinjene dva puta na modelima čeljusti izlivenim od tvrde sadre, prvi put prije početka izrade proteze, a drugi put na novim modelima dobivenim nakon izrade novih proteza. Prva analiza (prije izrade proteza) otkrila je da je ukupno 33,9% analiziranih zuba nosača bilo rotirano, 31,3% zuba bilo je nagnuto, 12,1% zuba nosača se pomaklo, a 57,3% zuba nosača bilo je elongirano iznad okluzijske ravnine. Na modelima dobivenim nakon što su napravljene nove djelomične proteze, uočeno je da nijedan od zuba nosača nije bio u potpunosti adekvatno prepariran. Samo je 37,6% retencijskih elemenata djelomične proteze bilo smješteno u adekvatnim podminiranim mjestima. Prema rezultatima ovog istraživanja može se ustvrditi da su prije izrade djelomične proteze mnogi zubi nosači bili rotirani, izduženi, nagnuti, čak i pomaknuti, što upućuje na potrebu preparacije takvih zuba prije izrade novih proteza, međutim niti jedan od analiziranih zuba nosača nije bio u potpunosti adekvatno pripremljen s obzirom na ravninu uvođenja djelomične proteze, a mnogi retencijski elementi proteze nisu bili smješteni na adekvatnim podminiranim mjestima.