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The influence of the design of mandibular major connectors on gingival health

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Abstract

Background: The objective of this study was to assess the influence of lingual bar and lingual plate major connectors on plaque retention and gingival health among patients who presented in University College Hospital (UCH), Ibadan, Nigeria.

Methods: This comparative intervention study was carried out among fifteen patients aged 28 to 60 years with Kennedy class III lower edentulous arch. Two metal dentures with different major connector designs (lingual plate and lingual bar) were fabricated for each patient. After professional scaling and polishing, a baseline score of the oral hygiene was done using the plaque index of Sillness and Loe and the gingival health using the gingival index of Loe and Sillness. Each patient was randomly assigned either a denture with the plate or bar design to use for three months and then recalled for reassessment of oral hygiene and gingival health. Professional scaling and polishing was done post removal and a new baseline assessment of oral hygiene and gingival health recorded. The dentures were now exchanged and the second major connector design inserted. Each patient was recalled for reassessment of the oral hygiene and gingival health after three months. The level of plaque accumulation and gingival inflammation with the use of lingual plate and bar dentures were determined and compared.

Results: There was no statistically significant difference in the mean plaque index score for the lingual bar design at three months and the mean plaque index score at three months for the lingual plate ($p>0.05$).

However, a statistically significant lower mean gingival index score was noted three months post insertion for lingual bar designs when compared to plate designs.

Conclusion: Within the limitation of this study, better gingival health was noted with the bar designs when compared with the plate designs.

Keywords: Removable partial denture, major connectors, gingival health

Résumé

Introduction: L'objectif de cette étude était d'évaluer l'influence de la barre linguale et de la plaque linguale des connecteurs importants sur la rétention de plaque et la santé gingivale parmi les patients qui ont admis à UCH, Ibadan, Nigéria.

Méthodes: Cette étude d'intervention comparative était faite parmi quinze patients âgés 28 à 60 ans avec la classe Kennedy III de l'arche édentée basse. Deux râteliers en métal avec de différents dessins de connecteur importants (la plaque linguale et le bar lingual) ont été fabriqués pour chaque patient. Après la mise à l'échelle professionnelle et le polissage, un score de base de l'hygiène orale a été défini en utilisant l'indice de plaque de rebord et Loe, et la santé gingivale en utilisant l'indice gingival de Loe et de rebord. A Chaque patient il a été attribué de façon aléatoire, soit une prothèse de la plaque ou soit un dessin en barre à utiliser pour trois mois, puis revenir pour la réévaluation de l'hygiène buccale et la santé gingivale. La Mise à l'échelle professionnelle et le polissage ont été faits après l'enlèvement et une nouvelle évaluation de base de l'hygiène buccale et la santé gingivale enregistrées. Les prothèses dentaires étaient désormais échangées et le deuxième grand dessin connecteur inséré. Chaque patient a été réévalué pour l'hygiène bucco-dentaire et la santé gingivale après trois mois. Le taux d'accumulation de la plaque dentaire et d'inflammation gingivale avec l'utilisation de plaque linguale et la barre des prothèses ont été déterminés et comparés.

Résultats: Il n'y avait aucune différence statistiquement significative dans la moyenne de l'indice de la plaque pour le dessin de la barre linguale à trois mois et la moyenne de l'indice de la plaque linguale à trois mois ($p>0.05$). Toutefois, une différence statistiquement significative de l'indice gingival de basse a été notée trois mois post-insertion de la barre linguale comparée aux plaques désignées.

Conclusion: Dans les limites de cette étude, une meilleure santé gingivale a été notée avec les fabrications de barre comparée avec la plaque.

Introduction

Major connectors are the components of removable partial dentures that join two saddles together or join

The difference between the mean gingival scores at three months post insertion for the lingual plate at baseline was 0.74 and 0.55 for the lingual bar respectively and was statistically significant $p < 0.05$. Differences between baseline and three months gingival index scores of 1.17 was noted in two patients with the lingual plate dentures, while no differences between the baseline and three months gingival index scores was noted in one patient with use of lingual bar (Table 2)

There was a general increase in gingival inflammation in both the plate and bar dentures three months after the wearing of each denture. This could be attributed to the harmful effect of plaque on the periodontium. Plaque is the main aetiological agent in the initiation and progression of chronic inflammatory periodontal disease [15]. The presence of removable partial dentures not only increases plaque retention but might also favour ecological changes that cause the overgrowth of flora like

Table 2: Distribution of gingival index scores for lingual plate and bar connectors

subjects	Lingual plate		D	Lingual bar		d
	Gingival score at baseline	Gingival score at 3 months		Gingival score at baseline	Gingival score at 3 months	
1	0.33	0.50	0.17	0.16	0.33	0.17
2	0.33	1.50	1.17	0.33	0.66	0.33
3	0.66	1.50	0.84	0.5	1.00	0.50
4	0.33	1.00	0.67	0.16	0.66	0.50
5	0.33	1.00	0.67	0.66	0.66	0
6	0.50	1.50	1.00	0.33	1.33	1.00
7	0.33	1.66	1.33	0.33	1.16	0.83
8	0.16	0.66	0.50	0.66	1.50	0.84
9	0.50	1.50	1.00	0.66	1.50	0.84
10	0.33	1.50	1.17	0.66	1.50	0.84
11	0.33	0.50	0.17	0.5	0.50	0
12	0.33	1.00	0.67	0.16	0.50	0.34
13	1.00	1.50	0.50	0.66	1.33	0.67
14	0.66	1.00	0.34	0.5	1.16	0.66
15	0.66	1.50	0.84	0.33	1.00	0.67
Mean (X)	0.45	1.19	0.74	0.44	0.99	0.55

d = refers to the difference in the gingival index at 3rd month and at baseline with use of lingual bar

D = refers to the difference in gingival index at 3rd month and at baseline with use of lingual plate.

$P < 0.05$

Discussion

The findings of this study reveal that there is an increased retention of plaque with the use of a lingual plate connector. This is in agreement with previous studies that reported more plaque collection under a lingual plate than under a lingual bar [15, 16]. In another study [4], it was demonstrated that, the major drawback of the lingual plate is its tendency to encourage plaque formation. This might be as a result of extension of the lingual plate to the cervical margins of the teeth which hinders the self cleaning effect of saliva on the teeth. In addition, the tissue surface of the lingual plate is not as highly polished as that of the lingual bar, this enhances the formation of bacterial plaque which forms more readily on rough surface than smooth surfaces [10].

spirochetes and motile organisms which is associated with periodontal disease [6].

However, a statistically significant higher mean gingival index score was noted for lingual plate designs when compared to bar designs. This is in agreement with previous studies [9, 17-19]. Yusof and Isa, [9] found that the teeth in contact with dentures were more affected by periodontal changes than teeth that were not in contact with dentures. Chandler and Brudvik [17], reported an increased gingival inflammation in areas covered by the removable partial dentures when compared with those areas which were not covered. Also, it was shown that coverage of the marginal gingivae by the denture component had an adverse effect on periodontal health [18,19]. The significant increased

Ethical approval was obtained from the University of Ibadan/University College Hospital Ethical Review Committee and informed written consent to examine and carry out the study was obtained from each participating patient before the commencement of the study.

Demographic data for each patient was obtained and recorded in the patient's data form. These include the age, sex, occupation, religion, and contact address of the patients. The teeth present and the missing teeth were also recorded.

After a thorough explanation of the study to the patients, each patient was randomly assigned to a group (group A or B) by picking a number from a box. The patients in both groups had scaling and polishing of the teeth and two dentures with a different connector design; lingual plate and lingual bar were fabricated for each patient. Patients in group A had the lingual bar inserted as the first denture, while those in group B had the plate inserted initially. At the point of fitting the initial denture, in either group, a baseline score of the oral hygiene using the plaque index (PI) of Sillness and Loe [13] and gingival health using the gingival index (GI) of Loe and Sillness [14] were determined for each patient. Post appliance instructions for the prosthesis were given verbally and in writing. Each patient was asked to wear each denture for a period of three months, but reviewed after 24 hours, three days and a week with adjustment made when necessary. At the three months recall visit, the plaque index and gingival index scores were recorded for each patient.

Post appliance scaling and polishing of the teeth was done after retrieval of the first set of denture and no denture was worn for a period of three days to allow the tissue to rest. Baseline plaque and gingival index scores were once again recorded, and then patients in both groups were given the second denture as assigned initially for the next three months. At subsequent recall visit, the oral hygiene and gingival health of each patient were assessed again.

The scores on the mesial, distal, lingual and labial surfaces of each index tooth were added and then divided by four to obtain the plaque or gingival index score for the tooth. The average score for the index teeth was then determined to obtain the score for each subject. When the index tooth is missing, the distal or mesial tooth was used to obtain the PI or GI score.

Data analysis was done using the Statistical Packages for Social Sciences (SPSS) version 16. Analysis included calculation of range, mean values and standard deviation. Power at 80% = 0.84 was

used in sample size calculation. Differences between means were tested using t-test (paired sample) analysis to assess significant difference in mean plaque and gingival scores recorded with the use of both the lingual plate and bar dentures. Level of significance was set at $p \leq 0.05$

Results

Fifteen patients participated in this study, of which eight were females and seven were males. The age range of the study group was 28 to 60 years. The mean age was 41.2 ± 10.4 (SD) years (Table 1).

Table 1: Age and gender distribution of patients

Age Range (yrs)	Sex		Total
	Male	Female	
<30	1	0	1
31 – 35	3	1	4
36 – 40	2	2	4
41 – 45	0	1	1
46 – 50	0	2	2
≥ 51	1	2	3
Total	7	8	15

The mean plaque scores three months post insertion of denture was 1.24 for the lingual plate and 1.06 for the lingual bar. There was no statistically significant difference in the mean plaque index score $p > 0.05$. Differences between the baseline and three months plaque index scores of 2.0 was noted in two patients with lingual plate dentures (fig 1).

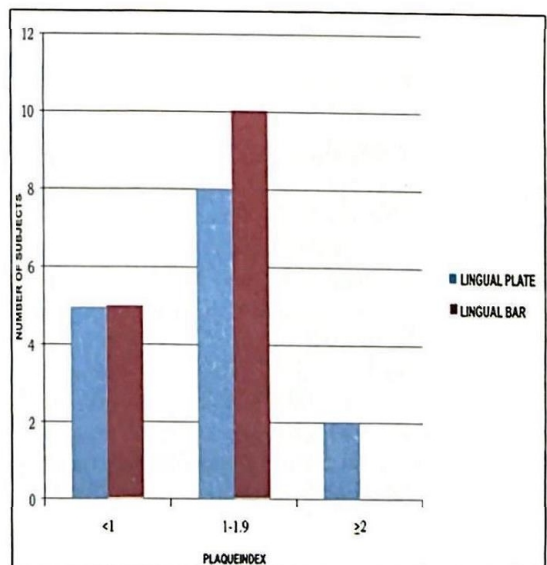


Fig 1: Distribution of plaque index for lingual plate and bar connectors

in gingival inflammation associated with the lingual plate when compared with the lingual bar in this present study may be due to the relatively rough tissue surface of the plate and its extension over the gingival margin. This probably enhanced plaque accumulation and possibility of a direct adverse physical effect on the periodontal tissue.

Contrary to the findings in this study, Bergman *et al.* [16], in a series of longitudinal studies of up to 10 years, reported no progression of periodontal disease and caries after insertion of removable partial dentures and concluded that oral hygiene is the main factor in determining the periodontal health of removable denture wearers. This might be due to differences in the periodontal indices (periodontal pocket depth and tooth mobility) used in the assessment of periodontal health when compared with the present study.

Conclusion

Within the limitation of this study, the major connector design in metallic partial dentures appears to have an influence on gingival inflammation. Significant gingival inflammation was recorded with lingual plate connector when compared with lingual bar connector.

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the use of some adjuvant therapy such as conjunctival or amniotic membrane grafts, intraoperative or postoperative application of topical 5-FU, Mitomycin C (MMC), Cyclosporin A, Thiotepe, β -irradiation, and Triamcinolone.

The efficacy of these adjuvant methods in preventing pterygium recurrence has been widely studied and determinants of recurrence following pterygium excision have been reported to include geographic location, age, gender, morphology and size of the pterygium [3]. Only a few studies have involved a combination of two methods to reduce recurrence and to the best of our knowledge there are no previous reports on risk factors for recurrence in an African population following combined use of antimetabolite and CAG.

We recently conducted a study to compare the efficacy of 5-FU with that of MMC in preventing recurrence of pterygium when used in combination with CAG in an African setting. The aim of this report is to identify the risk factors that influenced the recurrence of pterygia in these patients despite the use of combined strategies to prevent recurrence. Our findings regarding the efficacy of the combined strategy using CAG with either 5-FU or MMC in preventing recurrence of pterygia, after excision, have been reported earlier [5].

Materials and methods

This was a randomized controlled clinical trial that was carried out at the Department of Ophthalmology, University College Hospital (UCH), Ibadan, Nigeria, between October 2006 and September 2008. Ethical approval was obtained from the University of Ibadan/University College Hospital ethical review board, and informed consent was obtained from all subjects. We certify that all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during this research and this study was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Inclusion criteria included the following: fleshy or atrophic pterygium encroaching on the cornea by at least 2 mm and age greater than 16 years. Patients with recurrent pterygia were excluded. Patients with bilateral pterygia had the worse eye included, while the contralateral eye was excluded from the study. Included patients were randomized into one of the two groups. One group had pterygium excision and CAG with 5-FU, while the other group had pterygium excision and CAG with MMC.

The details of the sample size determination and randomization procedure are described in our

earlier report [5]. A minimum sample size of 35 subjects per group was calculated; however, a target sample size of 120 subjects (60 per group) was intended for the study in order to account for potential dropouts. Consecutive eligible participants who met the inclusion criteria were randomized into two groups using a stratified sampling technique [4]. Demographic information obtained from all subjects included age, sex, laterality, location, morphology, size of the pterygium (measured at a slit lamp from the limbus to the apex of the pterygium head), and visual acuity (VA).

Regarding morphology, pterygia were described as fleshy if the episcleral vessels were partially or completely obscured i.e. could not be seen on slit-lamp microscopic examination. Inflamed pterygia (those with hyperemia and congested vessels) were treated with topical steroids prior to surgery.

All surgical procedures were performed under local anaesthesia and with the aid of a microscope. The apex of the pterygium was first excised from the cornea. Then, the body was bluntly dissected from overlying conjunctiva and underlying sclera and excised. The use of cautery was minimized. Subsequently, depending on the treatment group, the bare sclera was exposed to either 50 mg/ml of 5-FU (Celon Laboratories, Hyderabad, India) or 0.01% MMC (Biochem, Mumbai, India) for five minutes followed by copious irrigation with 30mls of normal saline. Thereafter, a conjunctival autograft taken from the ipsilateral, pterygium free, superior bulbar conjunctiva was sutured to the recipient bed with interrupted 8-0 vicryl sutures, taking care to ensure proper orientation of the ends of the graft.

Postoperatively, both groups received instillation of chloramphenicol antibiotic ointment three times daily and dexamethasone (steroid) eye drops four times daily for between six and ten weeks, depending on duration of inflammation. They were also advised to wear dark glasses to reduce exposure to sunlight and other environmental irritants.

Post-operative follow-up visits were at days 1, 7, 21, 30, 60, and 90 and every 3 months subsequently. Recurrence of pterygium was defined as any regrowth of fibrovascular tissue across the limbus observed with a slit lamp microscope. This assessment was done by an independent, blinded observer who was experienced in the assessment of pterygium.

Of the 120 patients (60 per group) that were recruited and randomized, 10 patients (16.7%) in the 5-FU group and 25 patients (41.7%) in the MMC group did not turn up for surgery. Furthermore, four patients (6.7%) in the 5-FU group and one patient