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Comparison of functionally orientated tooth replacement and removable partial dentures on the nutritional status of partially dentate older patients: A randomised controlled clinical trial

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ABSTRACT

Objectives: The aims of this study were to conduct a randomised controlled clinical trial (RCT) of partially dentate older adults comparing functionally orientated treatment based on the SDA concept with conventional treatment using RPDs to replace missing natural teeth. The two treatment strategies were evaluated according to their impact on nutritional status measured using haematological biomarkers.

Methods: A randomised controlled clinical trial (RCT) was conducted of partially dentate patients aged 65 years and older (Trial Registration no. ISRCTN26302774). Each patient provided haematological samples which were screened for biochemical markers of nutritional status. Each sample was tested in Cork University Hospital for serum Albumin, serum Cholesterol, Ferritin, Folate, Vitamin B12 and 25-hydroxycholecalciferol (Vitamin D).

Results: A mixed model analysis of covariance (ANCOVA) indicated that for Vitamin B12 ($p = 0.9392$), serum Folate ($p = 0.5827$), Ferritin ($p = 0.6964$), Albumin ($p = 0.8179$), Serum Total Cholesterol ($p = 0.3670$) and Vitamin D ($p = 0.7666$) there were no statistically significant differences recorded between the two treatment groups. According to the mixed model analysis of covariance (ANCOVA) for Vitamin D there was a significant difference between levels recorded at post-operative time points after treatment intervention ($p = 0.0470$). There was an increase of 7% in 25-hydroxycholecalciferol levels recorded at 6 months compared to baseline ($p = 0.0172$). There was no further change in recorded levels at 12 months ($p = 0.6482$) and these increases were similar within the two treatment groups ($p > 0.05$).

Conclusions: The only measure which illustrated consistent significant improvements in nutritional status for either group were Vitamin D levels. However no significant difference was recorded between the two treatment groups.

Clinical significance: Functionally orientated prosthodontic rehabilitation for partially dentate older patients was no worse than conventional removable partial dentures in terms of impact on nutritional status.

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1. Introduction

Whilst replacement of natural teeth is required for restoration of oral function, aesthetics and quality of life there is also an ever increasing amount of evidence to suggest that teeth and oral health are also very important for systemic health and well-being.[1] It has been shown that as natural teeth are lost, chewing function can be negatively affected. This is associated with negative effects on dietary choice and nutritional status.[2] In older patients in particular, diet plays a very important role in systemic disease prevention, with poor diets implicated in bowel disease, osteoporosis and cardiovascular disease.[3]

In many counties, the majority of partially dentate older patients receive removable partial dentures (RPDs) to replace their missing natural teeth. However, less complex, functionally orientated treatment solutions are very applicable to partially dentally older patients. One of these is the Shortened Dental Arch (SDA) concept which aims to provide patients with a functional dentition of 10 occluding pairs of teeth or contacts without the need for a RPD.[4] By preserving mainly anterior teeth the SDA concept can offer patients an aesthetic result which they can easily maintain. Studies have shown that by providing 10 occluding pairs of teeth or contacts, patients can achieve suboptimal but acceptable levels of dental function.[4] Although the SDA concept has been shown to be acceptable to both patients and clinicians there is also evidence to suggest that it is currently an underutilised treatment approach.[5,6] Whilst a small number of patients will retain the 20 teeth necessary to achieve a natural SDA, a more realistic situation is that patients can be restored to a SDA. This can be done using a variety of fixed prosthodontic options including fibre reinforced composite resin, conventional bridgework and adhesive resin bonded bridgework (RBB). RBB has been shown to be an effective and simple way of replacing missing teeth to provide patients with a SDA.[7]

The aims of this study were to conduct a randomised controlled clinical trial (RCT) of partially dentate older adults comparing functionally orientated treatment based on the SDA concept with conventional treatment using RPDs to replace missing natural teeth. The two treatment strategies were evaluated according to their impact on nutritional status measured using haematological biomarkers.

2. Materials and methods

A randomised controlled clinical trial (RCT) was conducted of partially dentate patients aged 65 years and older (Trial Registration no. ISRCTN26302774). The patients were recruited from two centres: Cork University Dental Hospital (CUDH) and St. Finbarr's Geriatric Day Hospital (SFDH) in Cork, Ireland. Patients were included in the study if they were seeking replacement of missing natural teeth, could accept routine dental care in a dental chair, could communicate in English and had no medical conditions which precluded routine dental treatment. Patients were included in the study if they had a minimum of 6 sound remaining natural teeth in either arch in any position. Full ethical approval was granted for the study from the Cork Teaching Hospitals Ethics Committee (ref: ECM 5 (9) 05/02/08). Each patient was provided with an information sheet detailing the proposed treatment involved and each patient completed a written consent form prior to treatment.

All patients received standardised initial operative dental care to render them dentally fit. This included extensive oral hygiene instruction, non-surgical periodontal treatment, extraction of teeth with a hopeless prognosis and restoration of carious lesions or replacement of defective direct restorations. Patients were randomly allocated to two different treatment groups: the RDP group and the SDA group. For the RPD group each patient was also restored to complete arches with RPDs using cobalt-chromium frameworks to replace missing teeth. Each RPD was provided according to a standardised protocol which included primary and secondary impressions, surveying of mounted casts and framework design according to best prosthodontic principles. For the SDA group, patients were restored to a shortened arch of 10 occluding pairs of natural and replacement teeth using Resin Bonded Bridgework (RBB). The RBB was provided using a standardised protocol in each case. Minimal tooth preparation within enamel only was carried out to produce retentive forms and increase the surface area for bonding. The metal used for construction of each bridge was Nickel–Chromium (NiCr), which was sandblasted with 50 μm alumina on the fitting surface by the laboratory. Each bridge was constructed with a modified ridge lap pontic and in each case the prescribed metal thickness was 0.7 mm. Cantilever bridge designs were favoured in all cases for single unit replacement with fixed-fixed designs for 2 unit replacement. Panavia™ 21 (Kuraray Co. Ltd., Kita-Ku, Osaka, Japan) was used to cement each item of RBB. An occlusal examination was carried out on each item of RBB after cementation with modifications as necessary to ensure that the pontic was not involved in any lateral and protrusive excursive movements. All of the RPDs and RBB were constructed by the same dental laboratory. All operative treatment was conducted by a single clinician with postgraduate training in prosthodontics.

In this study randomisation was performed using a computer generated schedule in SAS®. Randomisation was in blocks of varying length and was stratified according to age and gender. Separate randomisation schedules were generated for both recruitment sites. Both treatment groups included patients recruited from both centres, randomised independently. Patient randomisation was conducted by a research assistant and the clinical operator had no involvement. No previous data was available to inform a power calculation based on haematological markers. Therefore the power calculation was made based on summary OHIP-14 score data from the United Kingdom Adult Dental Health Survey,[8] as change in Oral Health-related Quality of Life was another outcome measure in the study. Power was set at 80% with a one sided 5% level of significance. The power calculation indicated that 44 patients were required to complete the study from both treatment groups. However, to allow for a drop-out rate of up to 30% during the study, the aim was to over-recruit patients with up to 65 in each treatment group.

Each patient provided haematological samples which were screened for biochemical markers of nutritional status according to standard hospital protocols. Each sample was