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Increased risk for premolar tooth loss in shortened dental arches

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ARTICLE INFO

Article history:
Received 20 November 2012
Received in revised form
17 May 2013
Accepted 18 May 2013

Keywords:
Cohort study
Shortened dental arch
Removable dental prosthesis
Tooth loss
Survival

ABSTRACT

Objectives: To assess sustainability of shortened dental arches (SDA) by determining time to 'first restorative intervention' of teeth and time to 'tooth loss' and comparing these outcomes with complete dental arches (CDA) and SDA plus removable dental prostheses (RDP).
Methods: Data (follow-up time ranged from 27.4 (SD 7.1) to 35.0 (SD 5.6) years; max. follow up: 45.8 years) from patient records of 59 subjects (23 SDA, 23 CDA, and 13 SDA plus RDP) participating in a prospective cohort study on shortened dental arches (SDA) were analysed. Group effects on survival were analysed using Cox regression models; where appropriate Kaplan–Meier analyses were done.
Results: Compared to SDA subjects, CDA subjects had a lower risk to receive a first restorative intervention in anterior teeth (HR = 0.377; 95% CI [0.205–0.695]) and premolars (HR = 0.470; 95% CI [0.226–0.977]). CDA subjects had a lower risk to lose premolars compared to SDA subjects (HR = 0.130; 95% CI [0.053–0.319]). Risk for 'first restorative intervention' and for 'tooth loss' did not significantly differ between SDA with and without RDP.
Conclusions: SDA subjects had an increased risk to lose premolars and to receive a first time restoration in anterior teeth and premolars compared to CDA subjects. SDA subjects with RDP had no increased risk to receive a first restorative intervention or for tooth loss compared to SDA without RDP.
Clinical relevance: Subjects with shortened dental arches can be discerned as enduring at-risk patients. It is therefore recommended that shortened dental arch subjects receive intensive and continuous care to prevent further tooth loss.

1. Introduction

Over the last decades, a trend of an increasing number of subjects that retain more teeth during life is visible, at least in Europe.[1] However, in many situations the preservation of a complete natural dentition is biologically not achievable and/or not affordable. Consequently, many dentate subjects present with reduced dentitions that possibly need tooth replacements. A well-described, specific type of reduced dentitions is the so-called shortened dental arch. A shortened dental arch is defined as a reduced dentition with an intact anterior region but a reduced number of occluding pairs of posterior teeth starting from posteriorly. Systematic reviews

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0300-5712/$ – see front matter
http://dx.doi.org/10.1016/j.jdent.2013.05.013

addressing the shortened dental arch concept demonstrated acceptable functionality and stability,[2–4] whilst clinical studies do not demonstrate distinct advantages of restoring shortened dental arches with removable dental prostheses (RDP).[5–12]

Tooth loss is often the final consequence of dental diseases, therefore it can be stated that subjects with a shortened dental arch have a history of dental disease. It is reasonable to assume that a predisposition to dental diseases – such as in subjects with shortened dental arches – is not affecting exclusively the most posterior teeth, and will not disappear by extracting these teeth. Following this assumption, subjects with shortened dental arches would abidingly be at risk to lose remaining teeth.[13] On the other hand, there is abundant literature providing evidence that molars are at higher risk for tooth loss than other tooth types,[14–17] so it can be argued whether in shortened dental arches only teeth with 'low' risk for tooth loss remain.

Tooth loss endangers sustainability of the dentition. It is often the outcome of a complex history, which is not only influenced by dental diseases or other detrimental processes (i.e. tooth wear) and its sequelae, but also by the decisions taken by dentists when evaluating possible risk factors for rendering successful therapy.[18] Cumulative damage of teeth by subsequent restorative interventions during many years might lead to a dubious prognosis and extraction might be appropriate instead of further (expensive) restorative treatment with a doubtful long-term result.[15,18–20] However, if new tooth defects resulting from dental disease or other detrimental processes do not develop and tooth loss does not occur, it can be considered that a patient is at a state of low risk, which endorses sustainability of the dentition. In a shortened dental arch, continued tooth loss endangers not only the sustainability of the dentition as such, but due to its yet reduced number of teeth also its functionality.

Removable dental prostheses (RDPs) are often applied to compensate for loss of functionality of reduced dentitions. However, the sustainability of dentitions restored with RDP might be even at higher risk since wearing an RDP is associated with caries development, periodontal breakdown and tooth loss.[9,12,21–23]

The aim of this study was to analyse the sustainability of shortened dental arches by considering two clinical endpoints: (1) time to the first restorative intervention of teeth, and (2) time to tooth loss. Shortened dental arch subjects (SDA group) were compared with subjects with complete dental arches (CDA group). Additionally, the subjects with shortened dental arch were compared with shortened dental arch subjects wearing removable dental prostheses (SDA plus RDP group). We hypothesised that in shortened dental arch subjects hazard probabilities for 'first restorative intervention' and 'tooth loss' are higher compared to CDA subjects and lower compared to SDA plus RDP subjects.

2. Materials and methods

2.1. Data collection

Data from patient records of subjects participating in a prospective observational cohort study on shortened dental arches (SDA) were analysed. Detailed information on sampling method has been published previously.[24] Subjects from this study were attending the Nijmegen Dental School Clinic for their dental check-ups and treatments at the time (1981–1985) they entered the cohort study. This convenient sample included SDA subjects without free-end RDPs (SDA group; $n = 74$) and with free-end RDPs replacing absent molars (SDA plus RDP group; $n = 25$), and a control of subjects with complete dental arches (CDA group; $n = 72$). All SDA subjects (with and without RDP) had intact anterior areas and 3–4 posterior occluding pairs (POPs). The majority of the SDA subjects (94%) had one or more non-functional (i.e. not occluding) molars.

The criterion for inclusion of subjects of the original cohort study in the present analysis was the availability of a patient record at time of the analyses. Data were extracted from patient records that were administered following the Nijmegen Dental School protocol. If applicable, information recorded prior to the time the subject entered the cohort study was also used in the analyses. As an example, the subject with the longest follow-up time was a lady with an SDA who subscribed as a 28-year-old to the dental school in 1965, entered the cohort study in 1983, and is until to date a regular attender of the dental school. By including this information we were able to include follow-up data up to 45.8 years.

Presence and restorative status at baseline was recorded per tooth. Baseline was set at the date (1) a subject subscribed at the dental school (either having an SDA status or a CDA), or (2) tooth extraction resulted in a SDA status. During the follow-up period data on restorative interventions and tooth loss were extracted from retrievable patient records until May 2011 or until the most recent date that information was added to the record. Available X-rays were used to check the accuracy of the data. At the end of the follow-up period the principal investigator clinically investigated the majority of the 37 subjects still attending the Dental School; 5 out of these subjects were not available. The ethical committee of the Radboud University Medical Centre permitted the conduct of this study by decision cmo-nr 2010/316.

2.2. Statistical analysis

Two clinical endpoints were defined in the survival analysis comparing the groups: (1) 'first restorative intervention' (in anterior teeth and premolars that never received dental restorative treatment before), and (2) 'tooth loss' of anterior teeth and premolars. Molars were not included in the analyses. Cumulative survivals are presented by Kaplan–Meier survival curves.

Statistical package R, version 2.13.1, was used for statistical analysis.[25] To test the hypotheses, the SDA group was assigned to be the reference group. To analyse effects of the groups on survival, a Cox regression model was applied with group as independent variable and corrected for age. This was done for time to 'first restorative intervention' and time to tooth loss reduntant. Data on tooth level cannot be considered independent because multiple teeth per subject were included. Therefore, the Cox model was extended with a gammy frailty term to model this clustering of data.[26] In cases where