Non-adaptation to new mandibular complete dentures: A survival analysis and interpretation of the time to adaptation

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ABSTRACT

Purpose: To determine the average time it takes for patients to adapt to mandibular complete dentures and the factors associated with this critical period. Materials and Methods: A total of 108 completely edentulous patients were rehabilitated using complete dentures. Adaptation was evaluated based on the following criteria: mastication, comfort, speech, and swallowing with dentures. Kaplan-Meier analyses were used to estimate the average time to adaptation. Log-rank test was used to assess the adaptation period and associated factors. Results: Of the 108 rehabilitated patients, 89 had adapted to mandibular complete dentures at the 6-month follow-up. The mean time to adaptation estimated from the Kaplan-Meier curve was 78.54 days (95% CI: 71.04 to 86.04). The factors associated with the adaptation period were previous experience with a mandibular denture (P = .032), the professional who made the previous complete dentures (P = .034), frequency of appearance of traumatic lesions after 15 days of rehabilitation (P = .023), posterior mandibular ridge height (P = .005), and regular use of the
new dentures \( (P = .002) \). **Conclusion:** Most patients adapted to mandibular dentures after 2.6 months. No prior mandibular denture experience, use of old dentures made by a dental technician, occurrence of traumatic injuries 15 days after complete denture delivery, presence of a resorbed posterior mandibular ridge, and nonregular wear were associated with longer adaptation time to the new mandibular complete dentures. Int J Prosthodont 2022. doi: 10.11607/ijp.7865

**Introduction**

Edentulism is an irreversible debilitating condition that affects 2.1–32.3% of individuals aged >50 years and 0.1–14.5% of patients in younger age groups worldwide\(^1\). Studies reporting the prevalence of complete tooth loss have highlighted that the data are divergent and may vary according to differences between ethnic groups\(^2\), geographic regions\(^3\), or the socioeconomic development level of the country\(^4\). Although the trend for the prevalence of edentulism has decreased in several countries\(^5\), estimates indicate that the number of edentulous patients has not decreased due to the increase in life expectancy and persistence of factors that contribute to edentulism\(^6\)–\(^8\).

Traditionally, removable complete dentures (CDs) are the most accessible treatment to a large portion of the edentulous population\(^9\). CDs are capable of restoring masticatory function; improving speech, appearance, and socialization; and providing quality of life, and self-esteem to patient\(^10\). However, acceptance of a new denture, particularly the mandibular CD, is challenging, and patients require a variable time period to become naturally and comfortably accustomed to dentures, depending on the situation\(^11\).

Fenlon et al.\(^12\) showed that patients’ evaluations of mastication and comfort increased over time, improving the use of new dentures. Zarb et al.\(^13\) stated that 6–8 weeks is sufficient for neuromuscular adaptation to the new rehabilitation and satisfactory control of functional
activities with CDs. However, to date, very little attention has been paid to the time period needed for the adaptation to new mandibular CDs, and no previous study has investigated the factors involved in the celerity of adaptation to mandibular dentures.

Therefore, this study is justified by the absence of longitudinal studies that investigated the time required for the acceptance and comfortable use of new mandibular CDs and factors negatively correlated with this adaptation period. Thus, the purpose of this study was to determine the average time taken by patients to adapt to mandibular CDs and the factors associated with this critical period.

Materials and Methods

This non-randomized clinical trial with a follow-up period of 6 months was conducted in the Department of Dentistry at the Federal University of Rio Grande do Norte (DOD/UFRN) according to the Guidelines for Reporting Non-randomized Studies. Ethical approval was obtained from the institutional ethics committee of the Federal University of Rio Grande do Norte (UFRN) (protocol number: 3.949.924). The study was registered in the Brazilian Registry of Clinical Trials (REBEC; Identifier: RBR-22rb9m). One hundred and eight completely edentulous patients who required prosthetic treatment were evaluated for possible participation in this survey.

Participants were selected based on the following inclusion criteria: (a) edentulous patients aged ≥18 years, (b) users or non-users of CDs who needed to replace them, and (c) willingness to visit the clinic for denture adjustments during the recall appointment. The exclusion criteria were as follows: (a) pathological lesions in the alveolar ridges or oral mucosa; (b) inability to travel to the university for treatment; and (c) debilitating systemic conditions that could influence the assessment proposed in the present study.
All patients were informed about the treatment and written informed consent was obtained before commencing treatment. The patients’ anamnesis data were collected, and clinical examinations were performed. A questionnaire was administered to collect sociodemographic data and patient-related factors. Panoramic radiographs were obtained to evaluate the general structures of the face and identify any intraosseous lesions, residual roots, and/or factors that might interfere with the adaptation process and rehabilitation using CDs. In addition, the anterior and posterior mandibular bone heights were measured to verify the degree of residual ridge resorption. For mandibular bone height measurement, standard and digital panoramic radiographs were analyzed using the Radiocef Studio 3 software (Radiomemory, São Paulo, Brazil). The anterior and posterior heights were measured according to the method described by Xie et al. and updated by Marcello-Machado et al., and the ridges were classified according to the Prosthodontic Diagnostic Index developed by the American College of Prosthodontics. Ridges were classified based on the lowest vertical height of the mandible. The examiner (A.K.C.R.) was initially trained to perform repeated recordings in five patients with a 5-day break, and a Kappa > 0.8 indicated concordance.

The technical quality of existing CDs was evaluated using the methodology developed and validated by Sato et al. The questionnaire consists of seven significant parameters: 1, anterior teeth arrangement; 2, interocclusal distance; 3, stability of the mandibular denture; 4, occlusion; 5, articulation; 6, retention of the mandibular denture; and 7, border extension of the mandibular denture. The technical quality of the dental prosthesis was classified based on the sum of the scores obtained for each parameter, which ranged from 0 (score 3 for all characteristics) to 100 (score 1 for all characteristics). Values from 0 to 55 points indicated poor technical quality, 56 to 75 points indicated average technical quality, and values above 75 indicated good technical quality.
Patients received a set of new CDs fabricated according to the standard protocol of the dental prosthetics discipline at the university (clinical e-book), and the clinical steps were based on the recommendations of Zarb et al.\textsuperscript{13}. All CDs were fabricated over an average of five clinical visits using the conventional technique. Clinical procedures were as follows: (1) preliminary impression using irreversible hydrocolloid (Jeltrate, Dentsply, USA) in the upper arch and putty impression material in the lower arch (Perfil, Coltene, Brazil); (2) peripheral impression using a greenstick compound (Lysanda, SP, Brazil) and final impression using zinc oxide and eugenol (Lysanda, SP, Brazil); (3) adjustment of the occlusion rims, maxillomandibular relation record, and tooth selection; (4) wax try-in of the teeth and gum selection (Tomaz Gomes System, STG, VIPI, Brazil); and (5) delivery, control, and hygiene of the new CDs. Prior to delivery, the prostheses were remounted on the articulator for occlusal adjustment. Balanced occlusion was established in all CDs to attain stability by providing a balanced distribution of occlusal contacts, to facilitate adaptation to the new dentures\textsuperscript{13,20}. All CDs were fabricated by specialist prosthodontists in the same prosthetic laboratory. After delivery of CDs (first day of the study), recall visits were scheduled at 24 h, 7 days, 15 days, 3 months, and 6 months or whenever requested by the patient.

During recall visits, adjustments were made to relieve facial discomfort caused by erythema and ulcerations, and the adaptation and regular use of new CDs were assessed. The adaptation\textsuperscript{21} was assessed based on responses to four questions with dichotomous answering ‘yes’ or ‘no’: (Q\textsubscript{1}) ‘Can you chew into food with the new CDs?’ (Q\textsubscript{2}) ‘Are the new CDs comfortable to wear?’ (Q\textsubscript{3}) ‘Can you speak without difficulties with the new CDs?’ and (Q\textsubscript{4}) ‘Can you swallow food and water with the new CDs?’ A negative response to one or more questions revealed no adaptation to the new mandibular denture. The estimated average time for adaptation to new dentures was collected from the survival analysis over the follow-up period.
Categorical variables are described using frequencies and percentages to characterize the samples. The average time required to adapt to the new mandibular CDs was estimated from the survival analysis (Kaplan-Meier curve). The log-rank test was used to evaluate the association between these factors and adaptation time. All statistical analyses were performed using the IBM SPSS software v20 (IBM, SPSS Inc., Chicago, IL, USA). Statistical significance was set at $P < 0.05$.

**Results**

In total, 108 edentulous patients aged between 50 and 88 years (mean, $68.33 \pm 8.47$ years) were recruited for this survey. The study population consisted of 98 women (90.7 %) and 10 men (9.3 %). Regarding education level, 56.5% (n=61) had no more than eight years of schooling. Regarding the type of residual ridge, a large percentage of the patients had type III or IV ridges (70.4%, n=76), indicating the presence of a resorbed mandibular ridge. The average age at complete mandibular edentulism was $33.21 \pm 15.10$ years, and most participants reported previous experience with mandibular CD (84.3%; n=91). With regard to professionals who fabricated their old CDs, 52.8% (n=57) declared that their CDs were made by dentists. Regarding the technical quality of previous complete dentures, 66.7% (n=72), 10.2% (n=11), and 7.4% (n=8) of participants had poor-, average-, and good technical-quality dentures, respectively. The technical quality could not be evaluated in 15.7% of participants (n=17) who did not use a mandibular CD previously. Postoperative control visits showed a decrease in the frequency of traumatic injuries from 50.9% (n=55) at 15 days after rehabilitation to 20.4% (n=22) at 30 days after delivery of CDs.

In this study, based on the patients’ responses, the main problems that hindered adaptation to the mandibular denture were masticatory function and comfort with the new CDs.
(Fig. 1 and 2). At the 6-month follow-up, 95.4% (n=103) of participants responded to the four questions adopted as the adaptation criteria.

The average time for adaptation to CDs was determined using a Kaplan-Meier curve. The analysis included 89 patients and the corresponding number of patients that adapted to the mandibular CD during the 6-month follow-up. Of the 108 patients recruited to participate in this study, 17.6% (n=19) were not included in the analysis because they were unable to adapt during the follow-up period (n = 14; 13.0%) or were lost to follow-up (n=5; 4.6%).

At the initial assessment (t=0 days – delivery of the CDs), patients were not adapted to the mandibular CDs (adaptation survival=1.0). The curve shows the adaptation survival to CDs over time and the number of patients who did not adapt to mandibular CDs at the specified time intervals. However, at six months, 89 patients had adapted to mandibular dentures. Analysis showed that the average time to adaptation was 78.54 days (95% confidence interval [CI] 71.04–86.04), with minimum and maximum values of 15 and 180 days, respectively. The observed median was 75.00 days (95% CI 59.67-90.33) (Fig. 3).

The log-rank test was used to compare the two survival curves. Among the factors evaluated in this study, only previous experience with a mandibular CD (p=0.032), professionals who made the previous CDs (p=0.034), frequency of occurrence of traumatic injuries after 15 days of rehabilitation (p=0.023), height of the posterior mandibular ridge (p=0.005), and regular use of new CDs (p=0.002) were significantly associated with adaptation time. The findings showed that patients who had no prior experience with a mandibular CD, previously used dentures made by dental technicians, reported ulcers occurring in the first 15 days after rehabilitation with the new CDs, had a resorbed posterior mandibular ridge, and did not regularly use the new mandibular dentures took longer to adapt to the new CDs (Table 1) (Fig. 4A-E).
Discussion

This non-randomized clinical trial aimed to estimate the average time required for patients to adapt to a new mandibular CD and evaluate the factors associated with the time of adaptation. The results of the present study showed that the estimated average time for patients to adapt to new dentures was 2.6 months, and it was influenced by patient-related factors. In addition, a proportion of patients adapted to the new mandibular CD after 3–6 months, that is, after new memory patterns for the masticatory muscles were established and neuromuscular control that compensates for eventual deficiencies was acquired\textsuperscript{22,23}.

A previous study reported that treatment and denture success require time and patience\textsuperscript{24}. Surprisingly, even when using good-quality CDs and evaluation during recall visits, some patients have difficulty adapting to mandibular dentures and require more time to achieve optimal use and tolerance to their new dentures. Therefore, the adaptation process is a challenge for dentists and patients, because many problems arise before dentures can be comfortably and regularly used, and the period of adaptation may be influenced by patient-related factors\textsuperscript{25,26}.

This study confirmed that previous experience with mandibular dentures was associated with a shorter adaptation time to the new mandibular denture. Thus, participants who had used mandibular dentures in the past probably achieved steady-state or functional adaptation more rapidly than those without prior experience. Previous studies revealed a trend to believe that the acceptability of dentures may be hampered in first-time mandibular denture users, resulting in increased adaptation time\textsuperscript{27,28}. A possible explanation for this might be that new dentures interfere with peripheral answers, motor control, and neuromuscular development, which affect masticatory function and stability and increase the adaptation period in these participants.

Another important finding was regarding the professional who fabricated the previous dentures used by the patient before rehabilitation with new dentures and the association with adaptation time. Survival analysis revealed that users of old dentures made by dental
technicians required more time to adapt to new mandibular dentures. All new CDs were fabricated within the delimitation of the basal area. This suggests that the greater extension of the new CDs compared to old dentures may have hindered the adaptation process, and increased the tolerance period. It is important to provide a suitable basal seal to aid in mandibular denture stability and support\textsuperscript{29}, in addition to explaining the adaptation process to the patients and stressing the importance of regular use of new dentures.

Complaints, such as the appearance of erythema or traumatic injuries, are common after delivery of prosthetic devices, mainly during the initial days post-installation \textsuperscript{13,30}. In this survey, patients who reported a higher frequency of ulcerations after 15 days of rehabilitation with new CDs required longer adaptation periods. Previous studies have reported a tendency for traumatic injuries to the mandibular oral mucosa on the anterior and posterior vestibular flanks and piriformis papilla\textsuperscript{31-33}, which is consistent with the findings in the present study. The insertion of CDs is a critical step for edentulous patients because they struggle to adapt and accept new mandibular dentures. Hence, dentists should encourage patients to attend recall visits to help identify the zones of pain and discomfort and ease the process of adaptation.

We found that participants with resorbed posterior mandibular ridges required a longer average time to adapt to the new dentures. Considering the present results, the clinical management of patients with reduced or limited bone height should receive special attention in an attempt to understand the peculiarities related to their specific treatment and to favor the acceptance of mandibular dentures. The mandibular residual ridge has a less favorable shape, resulting in impaired stability and retention of the CD\textsuperscript{34,35}, which can consequently result in a prolonged adaptation period.

The results demonstrated that the regular use of mandibular dentures may impact adaptation time, contributing to the acceptability of CDs. Although many problems during functional adaptation are transitory, they may compromise treatment with new dentures\textsuperscript{36,37}. 

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depending on the patient's psychological profile, because rehabilitation with new dentures causes modifications in swallowing, mastication, comfort, and phonetics.

Previous studies have associated adaptation to new CDs with the frequency of occurrence of traumatic injuries, showing the importance of regular patient follow-up\textsuperscript{31-33}. The present study analyzed adaptation based on responses to dichotomous questions, which may be a limiting factor because it depends on patient perception and provides a subjective evaluation. Nevertheless, complaints regarding masticatory function, discomfort, and pain due to the use of new dentures are very common, mainly with mandibular CDs, and are associated with the level of tolerance, adaptation, and use or non-use of new dental prostheses. Therefore, follow-up and evaluation of the use of the new CD by the patients are important for the success of CD. In this clinical study, patients were asked about the adaptation criteria mentioned (phonetics, mastication, swallowing, and comfort) at 3 and 6 months.

The present study was designed to estimate the adaptation time for new mandibular dentures and associated factors. The findings broadly support that 3–6 months is a sufficient period for most patients to show a reduction in physiological discomfort and enhanced acceptance of CDs. The findings also highlight the importance of dentist–patient communication during treatment regarding the limitations and specific characteristics of the participants that delay this adaptation, which is helpful in the post-installation stage. Professionals should inform patients that the time to adaptation is variable and depends on multiple factors including oral health conditions. In addition, patients should be encouraged to adjust the dentures that injure the tissue support area and oral mucosa in recall appointments. This approach provides security to and improves the self-esteem of the patient and decreases anxiety, complaints, and misunderstandings, contributing to building patient rapport and trust, greater tolerance of the dentures, and faster adaptation.
Although good-quality CDs are made by experienced professionals, following standard protocols with follow-up and clinical appointments, some patients are unable to adapt to new CDs. In this situation, an alternative treatment option may be rehabilitation with a single mandibular implant-supported CD, because it is less invasive and cost-effective. Further studies in this field, particularly focusing on the correlation between adaptation time and psychological factors, should be conducted. Personality-based approaches may predict adaptive responses. Previous studies have shown that psychological and personality traits may be dominant factors associated with adaptation time and acceptance of dentures, mainly 3 months after delivery of new removable CDs\cite{38-40}. Patients with neuroticism have a greater tendency to complain about denture errors; they are more worried about aesthetics and have problems with interpersonal relationships and emotional changes, even with good technical-quality CDs.

Within the limitations of this clinical trial, the following conclusions were drawn:

1. The estimated average time of adaptation to mandibular CDs was 78.54 days (2.6 months) for the majority of patients.

2. No previous mandibular denture experience, use of old CDs made by a dental technician, occurrence of traumatic injuries after the first 15 days of rehabilitation with new dentures, presence of a resorbed posterior mandibular ridge, and non-regular use of new mandibular dentures were associated with increased adaptation time to the new dentures.

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Conflict of interest: The authors declare that there are no conflicts of interest.
References


Figure legends:

**Fig. 1** – Answers for 4 questions that confirmed the adaptation or no adaptation up to 3 months.
Fig. 2 – Answers for 4 questions that confirmed the adaptation or no adaptation up to 6 months.

Fig. 3 – Estimated average time to adapt to mandibular complete denture (MCD) at 6-months.

Fig. 4 – Kaplan-Meier curve. Survival curve of adaptation to mandibular complete denture at 6-month follow-up regarding previous experience with mandibular denture (A), professional who made the previous CDs (B), occurrence of traumatic injuries after 15 days of rehabilitation (C), height of the posterior mandibular ridge (D), and regular use of the denture (E).
A Previous experience with mandibular dentures

B Professional

C Traumatic ulcers after 15 days

D Posterior mandibular height

E Regular use of mandibular denture after rehabilitation
Table 1 – Estimated average time of adaptation in comparison with factors evaluated in this study.

<table>
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<th>95% CI</th>
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* Log-rank test (p<0.05).