Oral health of patients under short hospitalization period: observational study


Abstract

Objective: To assess the impact of hospitalization on the oral health status of individuals hospitalized for a short period of time.

Material and Methods: This was an observational study of hospitalized patients. The plaque index (PI), gingival index (GI) was measured at baseline (T0 – first 24 h of hospital admission), and at 3 (T1), 7 (T2), 14 (T3) days.

Results: One hundred and sixty-two patients were examined at baseline (T0), 35 examined at 3 days (T1), 23 at 7 days (T2) and 16 at 14 days (T3). The main reason for loss of patients was hospital discharge. The mean PI increased at T1 (0.97–1.21; p < 0.001), at T2 (1.06–1.30; p < 0.007) and at T3 (1.19–1.44; p < 0.03). Gingival index (GI) increased at T2 (0.74–0.96; p < 0.04) and at T3 (0.74–0.96; p < 0.02).

Conclusion: Oral health, assessed through PI and GI, deteriorates after a short period of hospitalization.

Hospitalization changes an individual’s routine, causing stress and anxiety due to the imminence of pain and discomfort and because pathological changes make the body more fragile (Delfini et al. 2009). It also tends to reduce patients’ self-esteem and they often neglect to care properly for themselves. They lose motivation to carry out routine oral hygiene habits, such as tooth brushing (Carrilho Neto et al. 2011). The scenario is worse when a patient has a physical limitation and/or the hospital environment creates barriers or difficulties that interfere with the adoption of healthy oral health habits (Zhu et al. 2008).

Poor oral hygiene contributes to the development and maturation of dental biofilm, the aetiological agent of most oral diseases. Pathogenic microorganisms in the dental biofilm have been implicated in infectious and/or inflammatory processes that compromise the function of organs and systems, contributing to increased morbidity and mortality (Seneviratne et al. 2011). Thus, pre-existing oral conditions of hospitalized patients can deteriorate or new conditions can onset (Needleman et al. 2012). An example are pulmonary infections caused by microorganisms of the oral cavity (Linden & Herzberg 2013). Furthermore, failure in maintaining adequate oral health status in the hospital environment can negatively affect the quality of life and the well-being of patients (Dhaussy et al. 2012).

Studies that assess the association between hospitalization and oral health have been conducted in intensive care units (with critically ill patients; Terezakis et al. 2011, Needleman et al. 2012); however, the majority of hospitalized patients are not treated in this environment.

Thus, the objective of this study was to investigate the impact of hospitalization on the oral health status of patients hospitalized for a short period of time in non-intensive care
units. Our hypothesis was that the oral health of patients deteriorates after hospitalization.

Materials and Methods

Study design and location

The study was carried out at one public and one private hospital in the city of Teresina, Piauí state, Brazil. It assessed hospitalized patients who were not in intensive care units. The patients had received various diagnoses for elective hospitalization and surgery, but had low levels of dependency and physical limitations. The private hospital had 16 beds and the public hospital had 52, for this type of hospitalization.

This study followed the guidelines of Resolution 196/96 of the National Health Council of Brazil and the Declaration of Helsinki (2008), governing research involving human subjects; it was approved by the Ethics Committee of the Federal University do Piauí – UFPI under protocol (05976112.9. 0000.5214).

Sample

All patients admitted to non-intensive care units were considered to be potential study participants. They were recruited within the first 24 h of admission to evaluate oral changes after hospitalization.

The hospitals were selected based on the nature of the services provided (one public and one private service); however, both hospitals offered the same type of medical services. The examiner recruited a convenience sample over a 3-month period.

Eligibility criteria

Inclusion criteria for participation in the study were as follows: being over 18 years and having more than six teeth. Patients were ineligible for the study when: their health condition meant examination of the oral cavity was not possible; they could not adequately respond to the questionnaire (e.g., psychological/cognitive disorders or being unconscious); they were using medications with a proven adverse effect on periodontal tissues, such as phenytoin and carbamazepine; they were undergoing radiotherapy or chemotherapy; or they were undergoing orthodontic treatment. Patients who had less than six teeth were excluded from the study after clinical examination.

Consent/assent

Those patients who fulfilled the above mentioned criteria were verbally and individually invited to take part in the study after an explanation of the objective and the methods to be adopted. They had to sign a consent form before answering the questionnaire and undergoing the clinical examination, according to the international guidelines for research with human beings.

Data collection

Data collection took place from June to September 2012 for the private hospital, and from October to December 2012 for the public hospital. Patients were invited to participate in the study, which consisted of two stages: Stage 1 – Answering a questionnaire addressing aspects of socioeconomic and demographic variables, and Stage 2 – the intra-oral examination.

Data collection from the questionnaire

Each participant’s socioeconomic and demographic data were collected along with his or her history of previous oral and medical health. Other collected data included: routine tooth brushing habits before and after hospitalization; and the existence of barriers or difficulties in the hospital that hindered them from carrying out oral health care procedures. During the interview, patients were in a hospital bed and remained in a comfortable position.

Clinical intra-oral examination

After the interview, clinical examination was carried out using an oral mirror and periodontal probe (North Carolina Probe, Millenium®, Cerri- tos, CA, USA) under artificial lighting (a flashlight). Teeth were dried with gauze pad for better visualization of clinical parameters. Patients were preferably examined lying on the bed so that their oral cavity was easy to visualize. A single dentist carried out the evaluations. A helper held the flashlight during the examinations. The patients were not informed of their oral health status and no oral health orientation was given to them.

Outcome assessment

The plaque index (PI) (Silness & Loé 1964) was used to assess the amount of biofilm. The patient’s teeth were individually scored according to the PI as follows:

- 0 = No plaque.
- 1 = A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be seen in situ only after application of disclosing solution or by using the probe on the tooth surface.
- 2 = Moderate accumulation of soft deposits within the gingival pocket, or the tooth and gingival margin which can be seen with the naked eye.
- 3 = Abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin.

Four sites per tooth (mesial, distal, buccal, and lingual) were assessed. The mean of the four scores was the tooth’s score. The mean score of all teeth was the patient’s mean score. Thus, the means for each observation period were compared to each other.

The gingival index (GI) was proposed by Löe & Silness (1963) and modified by Löe (1967) and was used to score gingival inflammation on probing, as follows.

Modified gingival index (Löe 1967)

- 0 = Healthy gingiva.
- 1 = Gingivae look inflamed, but do not bleed when probed.
- 2 = Gingivae look inflamed and bleed when probed.
- 3 = Ulceration and spontaneous bleeding.

Four sites (mesio buccal, central buccal, disto buccal and lingual) of each tooth were probed. The mean score of the four sites was the tooth’s score and the individual’s score was the mean score of all teeth. The mean of the observation period was the mean score of all
individuals, which were compared with each other.

Examiner’s training
The examiner was trained and calibrated by a Periodontist on how to conduct the clinical examinations and how to score the indices. During the first 2 weeks of the data collection, at baseline examination one in 10 patients was re-examined at the end of the data collection shift to calculate the intra-examiner agreement index. Five patients were re-examined and the agreement indices were 68.8% for the PI and 72.1% for the GI.

Efforts to address potential sources of bias
In our study, the same examiner was assigned to both baseline and follow-up visits to minimize variability. As a consequence, the patient’s identity could not be masked from the examiner; therefore, changes in the primary outcome might be due to assessment bias. The method found to minimize this bias was to prevent the examiner from having access to the data between visits.

Evaluation periods during hospitalization
After examination at baseline (T0 – n = 162), the follow-ups took place exactly on the third (n = 32 – T1), seventh (n = 23 – T2) and fourteenth (n = 16 – T3) of hospitalization. During the study, some patients were discharged; therefore there was an unintentional reduction in the sample after T0. At each observation period, the variables of a patient were compared with his/her own variables that had been recorded at the previous time period.

Data analysis
The collected data were processed using SPSS software (Statistical Package for Social Sciences, Armonk, NY, USA) version 15.0 for Windows. Quantitative variables were assessed for normality using the Komolgorov–Smirnoff test. For qualitative variables, chi-squared test and Fisher’s exact test were used. To compare means we used parametric (Paired Samples t-test) and non-parametric tests (Mann Whitney and Wilcoxon). The significance level adopted was 95% (p < 0.05).

Results
One hundred and ninety-eight patients were initially examined. One hundred and sixty-two (81.8%) were selected according to the inclusion criteria; 51.9% (n = 84) of them were at the private hospital and 47.1% (n = 78) at the public hospital. Sixteen patients were assessed throughout the four observation periods (Fig. 1).

There was no statistically significant gender predominance in the sample (p = 0.776 – Table 1). The mean age of patients was similar in both the private (51.1 ± 18.8 years) and public hospital (47.7 ± 17.9 years; p = 0.205). However, patients admitted to the private hospital had a higher educational level (p < 0.001) and income (p < 0.001) than patients in the public hospital (Table 1).

The diagnosed systemic diseases of the patients were grouped according to the International Classification of Diseases ICD-10. The private hospital had more hospitalizations due to digestive diseases (15.2%, n = 30), and the public hospital had more hospitalizations due to musculoskeletal system and connective tissue diseases (20.7%, n = 41; p < 0.001).

Patients at the different hospitals had the same oral health status at baseline (Table 2). The mean number of teeth per patient was 18.8 (SD 8.6 – minimum six teeth and maximum 28 teeth). The PI increased at the first observation period and onwards (Table 3). After 3 days (T1), the PI of the patients at the private hospital was significantly higher (p < 0.018). Patients remained in the public hospital for longer, which enabled a longer observation period. The GI increased at 07 days (T2: p < 0.04) and at 14 days (T3; Table 4).

There was a statistically significant reduction (p < 0.01) in the frequency of daily tooth brushing (as reported by the patients) during hospitalization, when compared with the frequency before hospitalization (Table 5). Despite the fact that 72% of patients reduced their daily brushing frequency, 82.7% reported no type of barrier that compromised the implementation of tooth brushing during hospitalization (Table 6). Neither of the studied hospitals had an oral health care protocol for non-intensive care unit patients at the time of this study.

Table 1. Socio-demographic characteristics of the sample according to type of hospital

<table>
<thead>
<tr>
<th>Variable</th>
<th>Private hospital</th>
<th>Public hospital</th>
<th>p</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>47.6</td>
<td>50</td>
<td>0.205</td>
<td>48.8</td>
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<tr>
<td>Female</td>
<td>52.4</td>
<td>50</td>
<td></td>
<td>51.2</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>Schooling (years of study)</td>
<td>9.86</td>
<td>5.15</td>
<td>&lt;0.001*</td>
<td>7.6</td>
</tr>
<tr>
<td>Income</td>
<td></td>
<td></td>
<td></td>
<td>162</td>
</tr>
<tr>
<td>Less than US$ 500</td>
<td>41.4</td>
<td>48.1</td>
<td>&lt;0.001*</td>
<td>89.5</td>
</tr>
<tr>
<td>Between US$ 500 and 1500</td>
<td>9.3</td>
<td>0</td>
<td></td>
<td>9.3</td>
</tr>
<tr>
<td>Above US$ 1500</td>
<td>1.2</td>
<td>0</td>
<td></td>
<td>1.2</td>
</tr>
<tr>
<td>Total</td>
<td>51.9</td>
<td>48.1</td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

*Statistically significant difference.
The oral health status of patients in the literature (Sjögren 2011), corroborating studies that have been carried out at intensive care units (ICU; Fourrier et al. 1998, Munro et al. 2003, Needleman et al. 2006). This study is unprecedented because it assesses non-ICU patients rather than ICU patients. Therefore, this study contributes to address the existing scarcity of information in this field. The results from this study corroborate the results of the previous observation period. However, we addressed this issue by comparing the individual in one given observation period to him/herself, instead of to the entire sample of the previous observation period. Furthermore, as the frequency of daily tooth brushings significantly reduced after hospitalization, there was no reason to believe that a larger sample would have produced different results.

Discussion

Short-term hospitalization at non-intensive care units had a negative impact on the oral health status of patients, corroborating studies that were carried out at intensive care units (ICU; Fourrier et al. 1998, Dennesen et al. 2003, Needleman et al. 2006, Needleman et al. 2012). This study is unprecedented because it assesses non-ICU patients rather than ICU patients. Therefore, this study contributes to address the existing scarcity of information in the literature (Sjögren 2011), regarding the oral health status of patients during hospitalization in non-ICUs. Non-ICU patients are more numerous than ICU patients and are usually admitted for a shorter period of time.

One of the possible causes of the oral health status deterioration was the reduction in tooth brushing and flossing frequency. Many hospitalized patients reported brushing their teeth daily, however, with a lower frequency than before hospitalization. The lower frequency may have caused dental biofilm to accumulate, which leads to the onset of or the increase in gingival inflammation, as seen from the PI and GI increases. Surprisingly, the PI increased even among the patients in the private hospital, despite the fact that they had a higher schooling level and a higher income. It is important to control dental biofilm control to prevent oral diseases (Seneviratne et al. 2011). One limitation of the study was the number of drop-outs throughout the observation periods. This seems to be a drawback that is also true of other studies (Needleman et al. 2012, Sachdev et al. 2013). However, we addressed this issue by comparing the individual in one given observation period to him/herself, instead of to the entire sample of the previous observation period. Furthermore, as the frequency of daily tooth brushings significantly reduced after hospitalization, there was no reason to believe that a larger sample would have produced different results.
barriers or inadequate infrastructure, such as the failure to provide washrooms, can make it difficult to perform oral health care procedures. Therefore, it is likely that the daily tooth brushing frequency fell because of psychological factors, such as the patients worrying about their health problem, as this reduction cannot be explained by the fact that they were physically limited by their illness.

This study found that the hospitals had no policies in place for routine oral health practices, and that no members of the multidisciplinary hospital teams assessed the patients’ oral health conditions during the hospitalization period. A properly executed protocol could help improve the oral health status of the patients. To implement such a protocol, a patient’s oral needs must be assessed (Costello & Coyne 2008). However, it is difficult to implement oral health protocols in hospitals due to the lack of information among the staff regarding oral health, the inadequate training of nurses and the fact that these institutions do not have the right equipment to provide patients with proper oral hygiene (Chan & Hui-Ling Ng 2012). Oral hygiene promotion measures could benefit those patients with no physical impairment during hospitalization, thus creating a healthy oral environment even in the short term (Hausen 2005). Furthermore, offering psychological support to patients with low self-esteem, and emphasizing the importance of good hygiene habits, could also prevent the deterioration of oral health (Renz et al. 2007).

Patients who are bed-bound, are unable to move or have physical disabilities would benefit from an oral health protocol. Such activities or by aiding the nurses, professionals would benefit from an oral health protocol, either by applying together with the hospital’s multidisciplinary hospital teams assessed the patients’ oral health status during the hospitalization period. Further studies, that document quantitative and qualitative bacterial changes in the oral cavity of patients hospitalized outside the ICU environment and the impact on tissue response should also be encouraged. Interventional studies should also be designed to assess the effect of oral health promotion measures on the patients’ oral needs must be assessed (Costello & Coyne 2008). However, it is difficult to implement oral health protocols in hospitals due to the lack of information among the staff regarding oral health, the inadequate training of nurses and the fact that these institutions do not have the right equipment to provide patients with proper oral hygiene (Chan & Hui-Ling Ng 2012).

Further analysis would be needed to assess the susceptibility of specific groups of patients to oral disorders during the hospitalization period. Furthermore, studies that document quantitative and qualitative bacterial changes in the oral cavity of patients hospitalized outside the ICU environment and the impact on tissue response should also be encouraged. Interventional studies should also be designed to assess the effect of oral health promotion measures on the patients’ oral health conditions during hospitalization.

Conclusion
The oral health status of hospitalized patients deteriorated after short periods of time. This was evident from the increase in dental biofilm and the increase in gingival inflammation.

The implementation of oral care protocols for patients hospitalized in non-ICUs, and the promotion of oral health measures could be used to prevent this scenario.

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References
Davies, G. M. & Davies, R. M. (2008) Delivering evidence-based protocols for patients hospitalized in non-ICUs, and the promotion of oral health measures could be used to prevent this scenario. Critical Care Medicine 36, 301–306.
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Clinical Relevance

Scientific rationale for the study:
Studies have shown that the oral health status of hospitalized patients deteriorates. However, few studies have provided data on the oral health status of patients who are not under hospital intensive care.

Principal findings: The plaque index increased at 3 days and gingival index increased at 7 days of hospitalization.

Practical implications: Because oral health deteriorates, patients would benefit from effective oral health care, which could be easily implemented through the creation of an oral health protocol. Barriers to implementation must be considered.