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Modeling occurrence of speech difficulties in patients with removable partial dentures

ABSTRACT

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Removable partial dentures (RPDs) is widely used as a remedy to tooth loses. Speech difficulty is one of the frequent problems associated with wearer of RPDs. This problem found to be steadily increases with maxilla RPDs whereas it founds to be intensively occurred in the interval 35-55 months of wearing. Probit model was performed much better than logit and simple linear regression models in predicting number of patients with specch problems according to the time intervals of wearing RPDs.

Introduction

Patients feel often uncomforted to any new substituted particle of their original body particles. This is true with new denture whether full or partial. The denture wearer may experience difficulty speaking and find themselves hyper salivating because of the bulkiness they feel. Pronunciation of many words may be difficult. The patient may have difficulty placing the tongue in the proper place as it learns to accommodate the new denture. Speech problems can include the denture teeth clicking when speaking. This could indicate that the denture no longer fits properly. Although excess saliva and/or dry mouth can also creating difficulty in the patient's speech¹⁻².

Changes in the oral cavity resulting from the loss of teeth (due to parodontopathy, caries, dentist injuries, etc.) and the resorption of the processus alveolaris maxillae, or the processus alveolaris mandibulae, may cause defects in the patient's voice and speech. The function of dentures (partial or complete), besides having aesthetic and masticatory functions, is to eliminate the above defects. From the functional point of view, the oral cavity (cavum oris) is part of the vocal apparatus³.

Alveolar ridge resorption after teeth extraction is a chronic, progressive and cumulative disease of bone reconstruction. Extensive residual ridge resorption is one of the many problems in prosthetic dentistry rehabilitation⁴.

It has been shown that after mandibular frontal teeth extraction, the distal part of the mandible is more in use and the resorption process is more extensive. The main reason for this is the influence of muscle activity on mandibular bone density in parts of the muscle attachments, after tooth extraction⁴.

Period of denture wearing is also very important in alveolar ridge resorption and has been proved to be positively related to more resorptive changes in the jaws compared to those who wear dentures for less periods of time³. The difference in resorption of the jaws increases within the first year of denture wearing, which proves that the mandible cannot resist the strong bite forces under the denture base. This is because of the smaller surface of the lower jaw. At the same time, the maxilla is less reduced because of the anatomical shape of the upper jaw (palatum durum resists the bite forces) and because of the greater surface of the denture base and better guidance of the bite forces (smaller amount of force on the unit of the ridge). In upper and lower complete dentures average pressure on the unit of the mandible is twice as high as the pressure on the maxilla



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because of the smaller contact surface with the supporting tissue⁴.

In addition to the previous discussion more than a quarter of all removable partial dentures (RPDs) fabricated are deemed unsuccessful⁵, where failure is defined as refusal or inability to wear the denture. Because of this failure rate many practitioners choose not to provide this treatment and prefer to refer these patients. Others provide alternative modalities such as implants. However, in many clinical situations a partial denture remains the only restorative option because of defects or because the patient is anatomic psychologically or financially unable to accept an implant. Speech problems associated with RPDs have been reported only rarely. However, when they do occur their impact is substantial and completely separate from masticatory and esthetic factors⁶. Frank and others⁷ reported that 17.9% of patients were dissatisfied with speech. Patients with communication problems had an average of 18.5 teeth⁸.

Patients and methods

During the period May, 2010 to June, 2011, a total of 337 participants were interviewed regarding whether or not they have speech difficulties related to their RPDs. Disregard the type and intensity of the problem, any of the participants mention discomfort during speaking he or she reported as a case of speech difficulty. The patients has been divided into two groups according to the place of their RPDs (maxillary or mandibular).

Simple presentation methods and advanced statistical methods were used to analyze the data collected from participants of this study.

The MATLAB R2011b programming environment was used to run programs of the probit, logit and simple linear regression.

Results

Table 1 shows the occurrence of speech difficulties with respect to the place of the RPDs and time intervals of wearing. Participants were classified into seven time intervals each of 10 months. Less than this interval width will resulted in empty cells and more

than these intervals will resulted in lost evidence when peak of such a problem due to.

Figure 1 shows the probabilities of occurrence at each time interval to both maxillary and mandibular. It is clear from this figure that speech problems is associated with mandible RPDs wearers. While the speech problems steadily increased in wearers of maxilla RPDs, it is remarkably increased in wearers of lower RPDs particularly at the intervals 35-55 month.

 Table 1: Occurrence of speech difficulties with respect to wearing time and type of RPDs.

	Maxilla		Mandible		Total		
Months	No. occ.	Total	No. occ.	Total	No. occ.	Total	
0-10	0	7	2	11	2	18	
10-20	1	15	3	18	4	33	
20-30	2	23	3	25	5	48	
30-40	5	35	5	31	10	66	
40-50	4	22	14	37	18	59	
50-60	6	20	10	33	16	53	
60-70	8	25	11	35	19	60	
Total	26	147	48	190	74	337	



Fig.1. Probabilities of speech difficulties with respect to wearing time and type of RPDs.

It is very important to model the occurrence of speech difficulties in order to study the behavior of this problem. In this context, the data of table 1 were subjected to three statistical models; probit, logit and simple linear regression. These models were carried twice once for the data of the maxilla participants and other for the data of the mandible participants. In both occasions probit model was found to perform better than the other two models. The performance of these odels were examined with respect to the mean square error (MSE).

Table 2 shows the results of the mean square error obtained from the three models in the two occasions.

 Table 2: Mean square errors obtained by the three models.

Model	MSE		
Widdei	Maxilla	Mandible	
Probit	0.1707	3.8407	
Logit	5.1320	9.0741	
Simple Linear Regression	0.4490	5.4694	

Figures 2 and 3 showed that probit model is much better fitted the data of the maxilla than the mandible. This is because mandible data has some fluctuation in the trend of progress according to wearing time. In both occasions probit model performs much better than the other two models.



Fig.3. Fitted values versus wearing intervals for the mandible RPDs.

Discussion

Early diagnosis of bone changes in the upper and lower jaw can result in early management of problems associated with RPDs and accordingly avoid further bone resorption and/or destruction. Of course speech problem is an indication of many dental problems that need to be corrected urgently.

Since the mandible bone received the highest pressure during chewing than maxilla, therefore it is not strange to notice the highest probabilities of speech difficulties corresponding to the wearing intervals of this bone.

The fluctuations of the probabilities of speech difficulties in lower bone RPDs is actually manifested by many factors like age, duration or period of wearing the denture, gender, chewing habits, type of foods and many other factors that contribute to this bone more than maxilla as stated previously.

Conclusions

- 1. The overall probability of speech problems for participants with mandible RPDs was found to be 0.25 and for the maxilla RPDs 0.18 and for the total 0.22.
- 2. The interval that contribute intensively to this problem in the mandible RPDs is 35-55 month.
- 3. Probit model was found to be very well fitted the data than the other two models.

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نمذجة حدوث مصاعب الكلام عند المرضى المستخدمين لاطقم الاسنان الجزئية المتحركة

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الخلاصة

تستخدم اطقم الاسنان الجزئية كعلاج تعويضي عن فقد الاسنان. تعتبر مصاعب الكلام الناجمة عن استخدام هذه الاطقم من المشاكل التي تواجه المستخدمين. لقد لوحظ ان هذه المشاكل تتزايد مع المستخدمين لاطقم الاسنان الجزئية العلوية ووجد بان هذه المشاكل تكثر في فترة الاستخدام التي تتراوح بين 35-35 شهر. لقد وجد بان النموذج Probit من حيث التنبؤ بعدد المستخدمين للاطقم الجزئية الذين يعانون من مشاكل الكلام بالنسبة الى فترة الاسخدام يعطي نتائج افضل من النموذج Logit ونموذج الانحدار الخطي.