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Left-to-right distribution of periodontal disease

Abstract: *Aim:* Symmetry is a property established in many human biological systems and it is reasonable to expect that it may also exist in the mouth. The objective of this study was to examine whether there is a similar left-to-right distribution in periodontal disease. *Method:* Records of 197 patients from the Periodontics department of The Royal Dental Hospital of Melbourne were analysed. The clinical parameters recorded were pocket probing depth, recession, bleeding on probing, mobility and furcation involvement. *Results:* The average age of our sample group was 47.5 years old, with 34.5% men and 65.5% women. The results demonstrated significant left-to-right distribution with all the periodontal indices recorded. *Conclusion:* The findings support previous studies that show that a similar left-to-right distribution exists in the population studied.

Key words: attachment loss; bleeding on probing; periodontal disease; probing depth; recession

Introduction

Periodontal disease is one of the most prevalent diseases in our society – affecting more than half of all dentate adults (1). In an ageing society, where individuals retain their natural dentitions for longer, it may be expected that more and more patients will present with some form of periodontal disease. Periodontal charting is necessary when attempting to diagnose and treat periodontal disease. The whole-mouth examination is the 'Gold Standard' periodontal analysis. It involves examination of six sites per tooth in all teeth. A thorough periodontal examination would be expected to give the most accurate information about a patient's periodontal health status. However, such an analysis is time-consuming, expensive, unnecessary for individuals with no or mild disease and inappropriate for large cross-sectional survey involving hundreds of subjects. Partial mouth assessment may examine only a few teeth such as the Ramjford teeth (2). Because periodontal destruction is both site and tooth specific and does not affect all parts of the mouth equally, it is unlikely that index teeth or limited sites would provide accurate representation of level and pattern of disease.

Symmetry may be defined as the property of being the same or corresponding on both sides of a central dividing line. It is a common feature of biological systems and can be observed many times in the human body (3). Symmetrical behaviour or left-to-right distribution has been suggested for infections, such as pneumonia (4), caries (5), tooth loss (6) and, more recently, periodontal disease (3, 7, 8). A few researchers have also been able to demonstrate that this pattern maybe observed radiographically (9, 10).

At present, there is very little literature concerning the distribution of periodontal disease within patients, particularly on how frequently disease

is associated in a symmetrical pattern. If in a majority of situations where a strong symmetrical pattern of disease can be expected, the clinician's technique and understanding of diagnosis, treatment and maintenance of periodontal disease may be altered. This would also allow the use of partial screening and recording of the mouth in epidemiological surveys. Further investigation is required in this area. Previous studies have not examined mobility or furcations (3, 7, 8). Knowledge that furcation involvement may be symmetrical may help in the treatment of these areas.

Therefore, the aim of this study was to investigate whether periodontitis exhibits a similar left- to right-hand side pattern of destruction by performing a statistical analysis of the clinical parameters of periodontal disease recorded in untreated patients when they first present for treatment.

Materials and methods

The project was approved by the ethics committee of both the University of Melbourne and Royal Dental Hospital of Melbourne. Retrospective demographic and clinical data were collected from 197 consecutive patients that were treated in the Periodontics department at the Royal Dental Hospital of Melbourne (RDHM) between 1999 and 2003. In order to be included, patients had to be over 18, had to have a diagnosis of generalized severe chronic periodontitis, which had not received treatment, and had minimum of 20 teeth. Only their initial periodontal charting at the examination appointment was considered, and all clinical parameters were recorded by periodontists or periodontics graduate students. Any medical conditions or medication usage was noted.

The clinical parameters recorded were periodontal pocket depths (PPD), bleeding on probing (BOP), recession (REC), mobility, furcation involvement and missing teeth.

Initial analysis of data indicated similar results at a site and tooth level, so for simplicity the data were analysed at a tooth level, as mobility and furcation are tooth level parameters. From the six periodontal probing depths charted per tooth, the average PPD for that tooth was recorded. The measurement of REC was also a single average value for each tooth. Bleeding on probing was considered as a simple sum of the six sites of each tooth, with the maximum value being six and the minimum being zero. Mobility was recorded as the number itself per tooth. Furcation was recorded as the sum of all furcation defects for each multi-rooted tooth, with a maximum of nine (three sites) for maxillary molars and a maximum of six (two sites) for mandibular molars. 'Paired-samples *t*-test' was used to assess the similarity between right and left side for continuous variables and Wilcoxon test for non-parametric parameters, with P set at 0.05 for statistical significance. An analysis of the effect of medical history on the left-to-right comparison was performed using the above tests.

Results

The overall data set comprised more women (129, 65.6%) than men (68, 34.5%) The average age of the patient group was 47.5 years with the range 20–75 years old. There was no effect of medical history on distribution, so all patients were included in the analysis.

There appeared to be a symmetrical pattern of tooth loss/missing teeth. Although the sample population had periodontal disease, absent teeth included all forms of tooth loss including congenitally missing teeth and unerupted teeth (Fig. 1). The third molars were the most commonly absent teeth and canines most often present.

Periodontal pocket depths/recession appeared to be similarly distributed between left and right sides (Table 1), with the molars exhibiting the greatest amounts of disease involvement (PPD > 4 mm). The upper right second molar was recorded to have the greatest average PPD of 4.1 mm, followed by the lower right third molar with an average PPD of

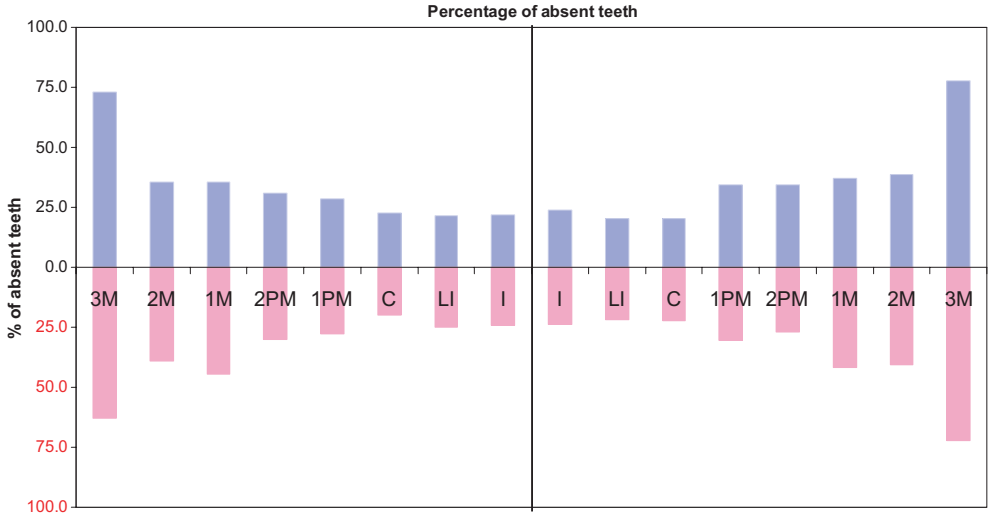

Fig. 1. Distribution and percentage of patients with absent teeth. The blue bars show the percentage of each tooth missing in the maxilla and the pink bars the mandible.

Table 1. **Periodontal pocket depths of teeth in the first and fourth quadrants compared with teeth in the second and third quadrants**

Tooth	PPD (mm)	SD	Tooth	PPD (mm)	SD	*n*	*P* value
18	3.99	1.28	28	3.99	1.18	36	1.00
17	4.06	1.27	27	4.02	1.29	121	0.72
16	3.77	1.05	26	3.75	1.09	131	0.85
15	3.33	0.99	25	3.19	1.03	139	0.11
14	3.34	1.20	24	3.28	1.18	144	0.45
13	3.12	1.11	23	3.07	1.05	176	0.53
12*	3.20	1.19	22*	3.01	1.07	180	0.00
11	3.17	1.15	21	3.17	1.25	175	0.96
48	4.01	1.42	38	3.85	1.24	49	0.30
47*	3.90	1.25	37*	3.70	1.11	119	0.03
46	3.63	1.23	36	3.56	0.98	108	0.52
45	3.08	1.14	35	2.96	0.98	152	0.13
44	2.87	0.91	34	2.87	0.96	157	0.95
43	2.96	1.08	33	2.85	1.01	182	0.07
42	2.90	1.27	32	2.83	1.11	179	0.35
41	2.70	1.05	31	2.71	1.05	178	0.86

*Mean difference significant at $P < 0.05$.
PPD, probing pocket depth in millimetres, shown with standard deviation; *n*, number of pairs of teeth analysed. The numbers of pairs are the same for mobility and furcation involvement.

Table 2. **Recession of teeth in the first and fourth quadrants compared with teeth in the second and third quadrants**

Tooth	REC (mm)	SD	Tooth	REC (mm)	SD	*n*	*P* value
18	0.93	0.66	28	1.35	0.59	8	0.16
17	1.83	0.95	27	2.01	1.16	53	0.24
16	2.03	1.15	26	2.00	1.16	72	0.85
15	1.47	1.02	25	1.52	0.91	57	0.71
14	1.56	1.12	24	1.40	0.82	50	0.21
13	1.40	0.84	23	1.38	0.87	51	0.35
12	1.54	0.97	22	1.52	1.15	46	0.86
11	1.43	0.91	21	1.44	0.80	55	0.88
48	1.16	0.56	38	1.61	1.09	10	0.13
47	1.43	0.69	37	1.42	0.64	37	0.93
46	1.71	0.90	36	1.53	0.89	47	0.18
45	1.60	0.90	35	1.69	1.04	68	0.44
44	1.57	1.00	34	1.56	1.07	65	0.94
43	1.71	1.10	33	1.61	1.06	75	0.31
42*	2.08	1.17	32*	1.75	0.91	87	0.00
41	2.07	1.22	31	2.00	1.25	105	0.22

*Mean difference significant at $P < 0.05$.
REC, recession in millimetres, shown with standard deviation; *n*, number of pairs of teeth analysed that had recession.

4.0 mm. In the maxillary arch, it was noted that the average probing depths in all teeth were between 3.0 and 4.1 mm. There was no statistically significant difference between the contralateral pairs, with the exception of the upper left and right lateral incisors ($P < 0.05$) (Table 1).

The mandibular teeth had average PPD ranging from 2.7 to 4.0 mm, except for the lower second molars. The agreement between contralateral teeth was greatest in the first premolars, followed by the lower central incisors.

Recession in these teeth exhibited a different pattern. Upper first molars and lower central incisors had the greatest amount of gingival REC (average = 2 mm), whereas others showed REC between 1 and 2 mm. Average REC values for the maxillary teeth were between 0.9 and 2.0 mm. Within each contralateral pair, average REC values exhibited symmetry. Within the mandibular arch, the lower right lateral incisor had the greatest REC at 2.1 mm, while the lower right third molar had the least amount of REC at 1.2 mm. The only pair that demonstrated significant difference between left and right was the mandibular lateral incisors ($P < 0.05$) (Table 2).

All teeth exhibited mobility values with a statistically significant symmetrical distribution (Fig. 2). Most teeth in both arches demonstrated symmetry with regards to mean BOP values, with the exception of upper and lower canines, and the lower first premolar (Fig. 3).

Furcation involvement of paired posterior teeth was found to have a similar left and right distribution although the strength of correlation between contralateral sides depended on the tooth in question (Fig. 4). The upper first molars showed the most consistency in the presence of furcation defects, as did the lower third molars, although the small number of paired lower wisdom teeth in the sample could make this an incidental finding. The upper second molars were least likely of the paired teeth to show symmetrical distribution of furcation defects. There were insufficient paired premolars with furcation involvement to assess their symmetrical distribution.

Discussion

A number of studies have shown a symmetrical correlation between clinical indices of periodontal disease (3, 7, 8). As reported previously, the same trend continued in this study. However, this study also showed similar left and right distribution in furcation involvement and mobility, not previously reported.

Mombelli and Meier (3) examined the impact of symmetry on variance observed in intra-oral topographic distribution patterns of chronic periodontitis. The impact of contralateral conditions was determined on the level of the site, the tooth and the quadrant. Significant correlations were detected between probing depths, REC, and attachment levels on the right and left side on all levels of analysis. The odds for bleeding increased significantly if the respective contralateral site was positive for the same parameter. As an example, the odds for bleeding on probing increased up to 10-fold if the contralateral site was bleeding.

Dowsett *et al.* (7) determined the periodontal disease status of an indigenous Indian community of rural Central America was performed in 125 unrelated subjects over 18 years of age using a single trained examiner recorded full-mouth PPD and clinical attachment levels. REC was derived from these measurements by subtracting the PPD from CAL for each site. The study results displayed remarkable symmetry of periodontal destruction patterns, as shown by the mean clinical

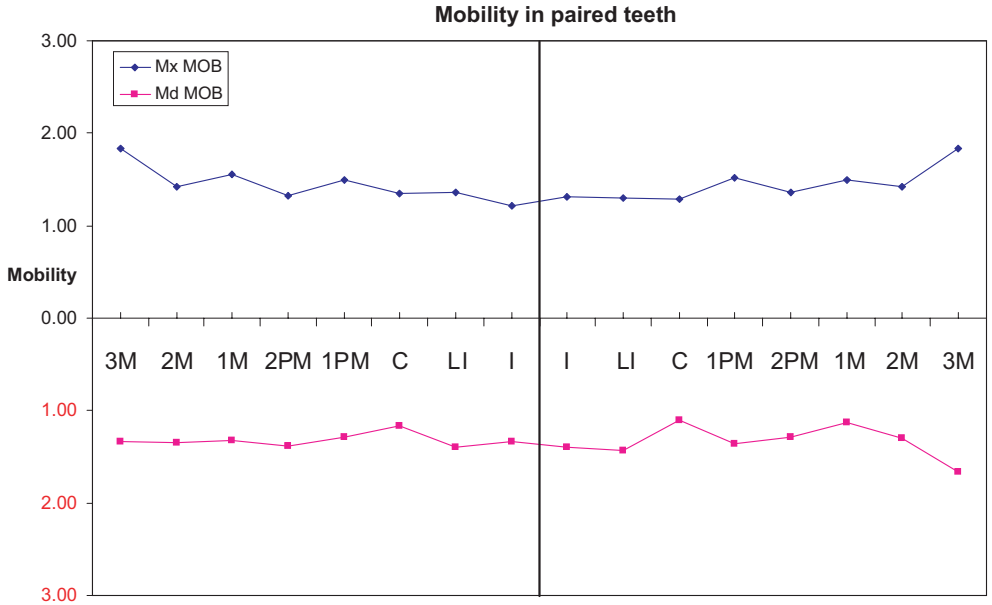

Fig. 2. Distribution of mobility of paired teeth in all patients. There were no significant differences between left and right sides. The blue line shows mobility of teeth in the maxilla and the pink line mobility of the mandibular teeth. The numbers of pairs are shown in Table 1.

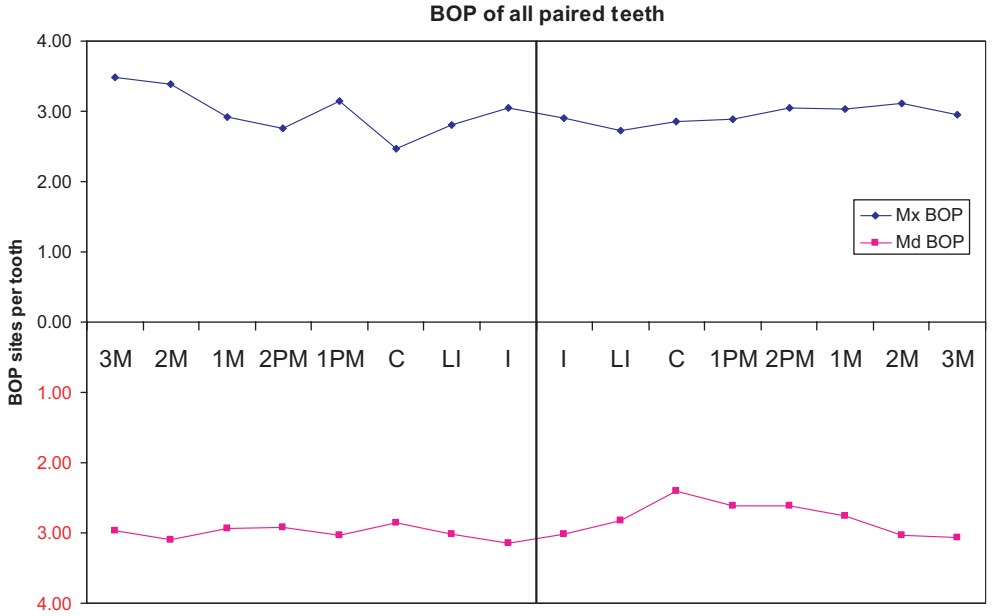

Fig. 3. Sum of bleeding on probing at all sites of paired teeth in all patients. There were no significant differences between left and right sides. The blue line shows bleeding on probing of teeth in the maxilla and the pink line the mandibular teeth. The numbers of pairs are shown in Table 1.

attachment levels, PPD and REC by tooth for all subjects in the study. It was concluded that left-to-right symmetry was present in this indigenous population.

Researchers have also been able to demonstrate that this pattern maybe observed radiographically. Baljoon *et al.* (9) examined the distribution of vertical defects and concluded that theses were more common in the posterior as compared to the anterior region of the dentition and that in both arches a right-hand to left-hand symmetry was noted. Persson *et al.* (10), who compared the accuracy of measuring bone levels on orthopantomograms, also noticed that bone loss was symmetrical.

Together these papers and this current study suggest that symmetry is present in periodontal disease and that the development of periodontal disease in any site cannot be explained by the influence of local factors alone. If disease is present on

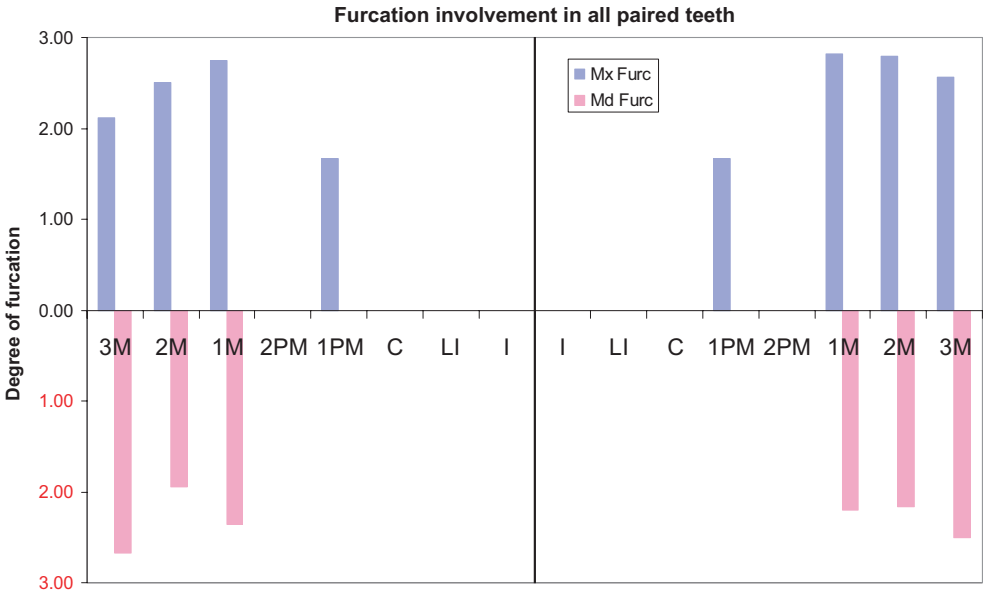

Fig. 4. Furcation involvement of the paired posterior teeth in all patients. A breakdown of each furcation showed a similar pattern. There were no significant differences between left and right sides. The blue bars show furcation involvement of teeth in the maxilla and the pink bars the mandibular teeth. The numbers of pairs are shown in Table 1.

one side, then the clinician may expect to find disease present at the corresponding teeth one the other side.

There were few instances where symmetry was absent and these appeared to be an exception to the general trend. Patient's dentitions (wear, caries experience, occlusion, etc.) may not perfectly symmetrical so certain local factors may results in differences in presence and severity of disease in paired teeth (11, 12). The presence of endodontic pathology, root fractures and trauma (including abfraction and abrasion lesions) of teeth would contribute to the development of localized periodontal disease that may not necessarily be matched in the contralateral tooth. It has been postulated that handedness (being right- or left-handed) can alter a patient's preference for delivering effective oral hygiene to one side or another, thereby altering the symmetrical distribution of local factors. Oginni *et al.* (13) reported that more non-carious lesions were found on the left side of right-handed subjects, possibly owing to forces of tooth brushing. In contrast to what may be expected with more forceful tooth brushing, Tezel *et al.* (14) found in right-handed subjects, gingival REC was more prevalent in the premolar and canine regions of upper right and lower right jaw while in left-handed subjects, gingival REC was seen on their upper and lower left jaws. This was not evidenced in the present study. Asking the patients whether they were left-handed or right-handed was not undertaken and is perhaps suggested in future studies.

Other factors that could have contributed to values with significant differences include having only a limited number of paired teeth, but given the number of subjects and the minimum requirement for 20 teeth to be included, this is unlikely. A number of clinicians examined the patients, but these were periodontists and periodontic postgraduate students reducing the possibility of inaccurate recording at the examination appointment. However, the same clinician assessed both right and left side of the same patient. In addition, any inaccuracies would probably be consistent throughout the patient's chart and probably not limited to one area. The majority of patients at RDHM represent a cohort of lower socio-economic status, and it has been shown in many studies that these patients have a higher incidence of periodontal disease. The population studied by Dowsett *et al.* (7) were indigenous Guatemalans and that of Mombelli and Meier (3) Swiss. Taken together, these suggest that a similar left-to-right distribution may occur irrespective of socio-economic status.

The similar left-to-right distribution of periodontal disease could impact on the diagnosis and treatment of periodontal disease. For the practicing clinician, the results of this study and others suggest that if any one tooth showed an increased value of any parameter, it can be reasonably assumed that its counterpart would be exhibiting a similar degree of disease. This may mean that more meticulous examination of the contralateral tooth is warranted. A more aggressive form of prevention could therefore be implemented at a contralateral tooth that may not yet show a similar degree of disease as its counterpart or more intensive therapy may be required than first thought. Furthermore, patients may be advised of the high possibility of the tooth on the contralateral side acquiring disease to a similar severity and therefore be more diligent in their home oral care regime. Likewise, where a periodontal examination reveals significant asymmetry in paired teeth, disease processes other than those of chronic periodontitis may need to be investigated, e.g. presence of more local factors such as overhanging margins or endodontic pathology.

Conclusion

This study has shown that periodontal disease has a similar left-to-right pattern showing strong correlation in paired teeth across the arch. For the practicing clinician, these results would infer that if any one tooth showed an increased value of any parameter, it could be reasonably assumed that its counterpart would be exhibiting a similar degree of disease.

Conflicts of interest

The authors do not have any conflicts of interest.

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