Dental Traumatology 2006; 22: 7–13

DENTAL TRAUMATOLOGY

Prevalence and risk of traumatic gingival recession following elective lip piercing

Leichter JW, Monteith BD. Prevalence and risk of traumatic gingival recession following elective lip piercing. Dent Traumatol 2006; 22: 7–13. © Blackwell Munksgaard, 2006.

Abstract – The aims of this study were to evaluate the prevalence, risk and odds ratios of gingival recession defects associated with elective lip piercing and wearing of stud jewelry, and to attempt to identify risk factors that might permit the incidence of recession and its severity to be predicted, using Miller's classification. Ninety-one subjects with lip piercing and labrets were evaluated with regard to gender, age, smoking history, orthodontic history, and labret characteristics. An age-matched group of 54 individuals without peri-oral piercing provided the control. Gingival recession was recorded on teeth opposing a labret in 68.13% of pierced subjects. By contrast, only 22.2% of unpierced individuals demonstrated recession. The odds ratio between pierced and control groups indicates a likelihood of recession 7.5 times greater in a pierced individual wearing a labret than in an unpierced individual. Logistical regression analysis showed that age, gender, smoking and labret configuration did not significantly influence the development of recession. Furthermore, an illustrative example indicates that piercing and provision of a labret might typically increase the risk of recession occurring from 34.4% (pre-piercing) to 80.8 %. Recession severity was greater in the pierced group, with Miller's class 2 and 3 defects observed in 18.7% of the pierced but not at all in the unpierced group. Ordinal regression identified previous orthodontic treatment as the only significant predictor of Miller's grade. We concluded that a clear link exists between lip piercing, labret use and gingival recession. Belief that labret placement and configuration can be modified to provide protection is unfounded.

Jonathan W. Leichter,
Brian D. Monteith

Department of Oral Rehabilitation, University of Otago School of Dentistry, Dunedin, New Zealand

Key words: gingival recession; oral piercing; stud jewelry; dental trauma; logistic regression; ordinal regression

Dr Jonathan W. Leichter, Department of Oral Rehabilitation, School of Dentistry, University of Otago, PO Box 647, Dunedin, 9001, New Zealand
Tel.: + 64 3 479 5958
Fax: + 64 3 479 5079
e-mail: jonathan.leichter@dent.otago.ac.nz

Accepted 11 September, 2004

Marginal gingival recession is the displacement of the soft tissue margin apical to the cemento–enamel junction (CEJ), with exposure of the root surface. Many factors have been proposed as playing an etiological role and a recent literature review (1) has considered such possible determinants as plaque-induced inflammation, toothbrush trauma, tooth alignment, orthodontic treatment, restorative procedures and the placement of stud jewelry or labrets into peri-oral piercings. The last-named of these has only recently attained prominence as a sociological phenomenon: its practice is still largely unregulated and in the relative absence of scientific data, is subject to unsubstantiated myth and opinion as regards any negative effects it might exert on recipients.

The practice of body modification is not new, but rooted in antiquity – having been reported across a wide range of cultures (2–5). Many of these practices have had a traditional significance (2, 6–8). However, the links of some with their mystic or ritualistic origins have become increasingly blurred by Western culture, which is currently witnessing a popularization of practices such as body piercing and tattooing as personal expressions of esthetics, daring and trendiness (3, 7, 9).

Oral and facial piercing, as part of this phenomenon, have seen a rapid increase in popularity (6, 7, 10, 11). Several anecdotal case reports in the dental and medical literature have highlighted the dangers that are associated with piercing (7–9, 11, 12), describing conditions that have ranged from the relatively benign discomforts of transient inflammation to serious, life threatening conditions such as Ludwig's angina (13). To date, only isolated case reports of oral trauma associated with intraoral and peri-oral piercing have appeared in print (14–18). However, few reports offer guidelines for the dentist to assess the risk of gingival damage arising as a result of lip piercing and the wearing of stud jewelry. Nor is there any evidence with which to counter the unsubstantiated assurances of often well-intentioned piercing-providers that appropriate positioning and configuration of stud jewelry will preclude any damage to the oral tissues.

The objective of this study was to explore the relationship between elective lip piercing and gingival recession. This would address the hypothesis that lip piercing and the wearing of stud jewelry place an individual at significantly increased risk of sustaining recession of the opposed gingival area.

Method and materials

Ninety-one individuals with peri-oral piercing of the lower lip in the labio-mental groove below the vermilion border and currently wearing a jewelry stud (labret) were invited to participate in a cross-sectional study (Fig. 1). These individuals were alerted to the study by the School of Dentistry's screening clinic, by referral from private practitioners or in response to notices calling for participants for this study. The dental status of these individuals was unknown by the referring party. They were referred for participation in the study solely on the fact that they had a labret in place.

Questionnaire and clinical examination

Each individual completed a short questionnaire that provided the following information: sex, age, date of piercing, orthodontic history, piercing in other areas of the body and smoking history.

One of the authors (JWL) performed a clinical examination of the teeth and gingivae directly opposed to the labret's inner disk (Fig. 2). The teeth most often in contact with the labret were 31 and 41. Patients with asymmetric piercing resulting in direct contact of the labret with teeth other than 31 and 41 were excluded from the study. Data collected in the clinical examination include:

- length of labret shaft (mm) and slope (straight or angled)
- lip thickness (mm)
- position of labret [contact on coronal tooth aspect (coded as 3), CEJ (coded as 2) or gingiva (coded as 1)]
- soft tissue envelopment of retaining disc [flush with tissue surface (coded as 0); submerged (coded as 1); protruding (coded as 2)]
- gingival recession (mm)
- keratinized tissue (mm)

Gingival recession and the amount of keratinized tissue present on the study teeth were measured by one examiner (JWL) using a calibrated periodontal probe, the mucogingival junction being established either visually or by means of gentle mucosal manipulation. Intraoral photographs of the lower anterior teeth and gingiva were taken of all subjects. Recession defects where noted, as measured from the CEJ and then categorized according to the Miller's classification (19). To control intra-examiner consistency, every fifth subject was flagged for later re-measurement with the purpose of comparing photographic image against clinically determined Miller's classification category. As a control, an age matched group of 54 individuals without

Fig. 1. Lip stud (labret) of the pattern investigated in the study.

Fig. 2. Typical gingival response to labial piercing and wearing of a labret is evident relative to lower central incisor teeth.

piercing or a labret was also examined. These individuals completed an identical questionnaire and all clinical data unrelated to piercing or labret characteristics were recorded.

Statistical methods

Descriptive statistics were determined for the two groups, as listed in Table 1. Qualitative data common to both groups were coded: gingival recession on the labial aspect of either 31 or 41 served as the binary dependent variable, being coded as 1 if present, or 0 if absent; while sex, piercing status, previous orthodontic treatment, piercing elsewhere and smoking were each cross-tabulated with 'recession' and tested for statistical association, using Pearson's chi-square test (Table 2).

A contingency table of recession frequency rates was constructed to permit calculation of relative risk and odds ratios between the pierced and control groups, as detailed in Table 3.

Table 1. Descriptive statistics ($n = 145$)

	Pierced	Not pierced
Males	39	30
Females	52	24
Total	91	54
Age (years)		
Mean (SD)	25.13 (3.69)	25.78 (3.99)
Range	20–43	20–43
Smokers (%)	46.2	18.5
Previous orthodontics (%)	23.1	25.9
Recession (%)		
Miller's class 1	50.5	20.4
Miller's class 2	17.6	0
Miller's class 3	1.1	0
Time labret worn		
Range	1–86 months	
Mean	11.86 (SD 16.4)	

Table 2. Chi-square cross-tabulation tests of independence

	(0) no recession	(1) recession	Chi-square	d.f.	*P*-value
Sex					
0 (male)	34	35			
1 (female)	37	39	0.005	1	0.943
Piercing status					
0 (not pierced)	42	12			
1 (pierced)	29	62	28.584	1	0.000*
Previous orthodontics					
0 (no)	57	53			
1 (yes)	14	21	1.484	1	0.223
Piercing elsewhere					
0 (no)	40	22			
1 (yes)	31	74	10.481	1	0.001*
Smoker					
0 (no)	49	44			
1 (yes)	22	30	1 .438	1	0.230

*Cross-tabulation of 'piercing status' with 'piercing elsewhere' returned a chi-square value of 52.713, with d.f. = 1 ($P < 0.001$), indicating a strong association between the two variables.

Table 3. Contingency table depicting rate of gingival recession in a group of subjects with labial piercing and a labret compared with a control group of unpierced individuals

	Gingival recession observed	No recession observed	Row total
Pierced with labret	62 (A)	29 (B)	91 (A + B)
Not pierced	12 (C)	42 (D)	54 (C + D)
Column total	74 (A + C)	71 (B + D)	145

Relative risk:
Gingival recession rate amongst subjects with lip piercing and a labret is A/(A + B): i.e. 62/91 = 0.6813.
Gingival recession rate amongst subjects without lip piercing and labret is C/(C + D): i.e. 12/54 = 0.2222.
Relative risk is $\frac{A/(A+B)}{C/(C+D)}$ i.e. $\frac{62/91}{12/54} = \frac{0.6813}{0.2222} = 3.066$.
Odds ratio:
Odds of gingival recession in pierced group are A:B i.e. 62/29 = 2.138.
Odds of gingival recession in unpierced group are C:D i.e. 12/42 = 0.2857.
Odds ratio is A:B/C:D i.e. $\frac{62/29}{12/42} = \frac{2.1379}{0.2857} = 7.487$.

Logistic regression analysis

Logistic regression analysis was applied to the combined sample of 145 individuals using the 'Entry' Method of the 'SPSS v.11.5.0' statistical package's *binary logistic regression* function, with the cutpoint set at 0.5. Gingival recession on the labial aspect of either 31 or 41 was coded as 1 if present, or 0 if absent and served as the binary dependent variable for the logistic regression analysis. Parameters common to both groups – sex, age, piercing status, previous orthodontics and smoking were investigated as independent (or explanatory) variables. Regression coefficients were generated by the SPSS function as part of a predictive model and are listed in the second column of Table 4 under the heading B coefficients. These are applied to a regression formula by multiplying each coefficient by its respective independent variable value and summating the products as a means of determining the log odds of recession that might be expected to arise in any individual case. Although risk cannot be directly determined in a case-control study, it can be indirectly inferred in terms of the relationship of odds to probabilities. With Odds = $[P/(1 - p)]$ and consequently $P = [\text{Odds}/(1+\text{Odds})]$, solving for P will yield the probability or risk of gingival recession arising in response to a particular combination of parameters.

Ordinal regression analysis

In view of prevalent opinion amongst piercing practitioners that tissue damage can be avoided by manipulating the labret's placement characteristics,

Table 4. Logistic equation parameters

Predictor	B (coefficients)	SE	Wald	d.f.	*P*-value	Exponents(B)	95% confidence	Interval
Sex (f = 1, m = 0)	−0.378	0.396	0.912	1	0.340	0.685	0.316	1.488
Age	0.069	0.052	1.758	1	0.185	1.071	0.968	1.186
Piercing status	2.081	0.508	16.767	1	0.000*	8.016	2.960	21.709
Previous orthodontics	0.791	0.481	2.710	1	0.100	2.206	0.860	5.658
Piercing elsewhere	0.255	0.540	0.223	1	0.637	1.290	0.448	3.716
Smoker	−0.086	0.452	0.036	1	0.849	0.917	0.378	2.226
Constant	−3.139	1.426	4.849	1	0.028*	0.043		

Wald statistic is ratio of B to SE of B, squared. *P*-value <0.05 indicates that parameter is useful to model.

further analysis was applied to the 91 pierced members of the study to determine the effect of such characteristics, and whether additional parameters, specific to the labret, might provide a basis for predicting the particular Miller's class of recession that might be expected to ensue. To this end, ordinal regression analysis was employed, using SPSS's PLUM protocol, with logit as the link function. Miller's classes 0 (no recession) 1 and 2 were selected as the ordinal dependent variable (a single instance of class 3 was deemed insufficient to serve as a separate class and consequently, was included with class 2 as class 2+). Explanatory (independent) variables included the previously used general parameters, together with the following additional labret-associated parameters: time since piercing, shaft angulations, the amount of play permitted (length of labret shaft minus lip thickness), resting position of the labret disk (relative to opposing dental structures) and the disk's submergence code. Measurements pertaining to recession depth and width of attached gingiva present were excluded as not being independent of the Miller's categories.

Ordinal regression extends logistic regression beyond simple binary prediction (recession/non-recession), by permitting one to calculate the probability of a predicted dependent variable value falling into each of a succession of ordered categories (in this case, Miller's classes 0, 1 and 2+). The model (20) achieves this by positing an underlying 'latent', continuous scale variable that is divided up into a series of contiguous numeric intervals, one for each of the ordinal categories being investigated. The points of demarcation between them are exemplified in Table 5 by the threshold values at the head of the 'Estimate' column, where the value for 'Miller's = 0' provides the threshold between Miller's categories 0 and 1, and that for 'Miller's = 1', the threshold between categories 1 and 2+. The coefficients (as with logistic regression) are multiplied by their respective explanatory variables and the products summed. Algebraic manipulation is then used to predict the category interval that contains the highest probability value. This will reflect the Miller's category that has the highest probability of occurrence relative to the particular combination of explanatory variables present in any individual case.

The strength of the predictors will determine how closely the model is able to match prediction against the observed dependent variable. To test this, decision matrix analysis was applied (Table 6) to calculate sensitivity, specificity, as well as positive and negative predictive power, as they pertain to the ordinal regression model.

Table 5. Ordinal equation parameters

	Estimate	SE	Wald	d.f.	*P*-value	95% confidence	Interval
Threshold							
Miller's = 0	−1.444	1.694	0.727	1	0.394	−4.764	1.875
Miller's = 1	1.198	1.696	0.499	1	0.480	−2.127	4.522
General parameters							
Sex (f = 1, m = 0)	−0.555	0.460	1.455	1	0.228	−1.457	0.347
Age	−0.042	0.060	0.490	1	0.484	−0.160	0.076
Previous orthodontics	1.638	0.545	9.049	1	0.003*	0.571	2.706
Piercing elsewhere	−0.021	0.556	0.001	1	0.970	−1.110	1.068
Smoker	0.580	0.450	1.659	1	0.198	−0.302	1.462
Labret parameters							
Time since piercing	0.022	0.013	2.771	1	0.096	−0.004	0.049
Angulation	−0.477	0.512	0.869	1	0.351	−1.481	0.526
Play	−0.021	0.127	0.026	1	0.871	−0.270	0.229
Disk resting	0.040	0.235	0.029	1	0.865	−0.420	0.500
Disk submerged	0.177	0.223	0.632	1	0.426	−0.260	0.615

* *P*-value <0.05 indicates that parameter is useful to model.

Table 6. Classification matrix derived from ordinal regression of pierced cases ($n = 91$) using Miller's recession categories 0,1 and 2+ as the ordered dependent variable

	Gingival recession, observed	No recession observed	Row total
Gingival recession predicted	55* [A (TP)]	19 [B (FP)]	74 (A + B)
No recession predicted	8 [C (FN)]	9 [D (TN)]	17 (C + D)
Column total	63 (A + C)	28 (B + D)	91

TP, true positives; FP, false positives; FN, false negatives; TN, true negatives.
*Miller's class 1 cases: correctly predicted, 38; class 1 cases: overpredicted as class 2+, 2; class 2+ cases: correctly predicted, 3; class 2+ cases: underpredicted as class 1, 12.

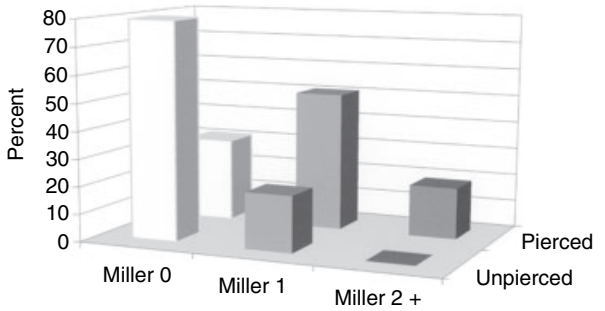

Fig. 3. Comparative prevalence of gingival recession in pierced and unpierced groups with severity differentiated according to Miller's classification.

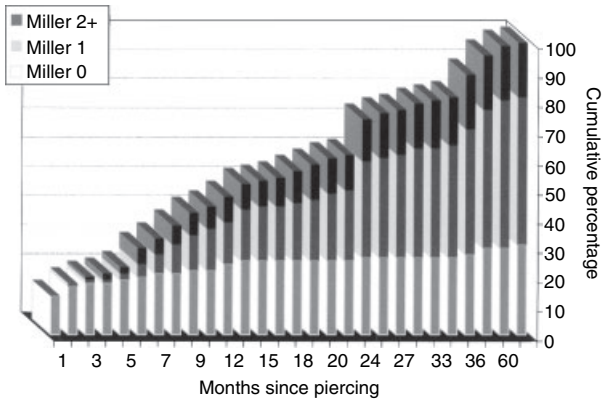

Fig. 4. Effect of time on occurrence and severity of gingival recession as expressed by cumulative percentage of individuals who had been wearing labrets for periods ranging from 1 to 86 months.

Results

Intra-examiner reliability was determined to be reproducible with a 100% correlation between the Miller's classification determined at clinical examination and a subsequent blinded classification performed on intra-oral photographs.

The *descriptive statistics* relating to the 145 individuals in the study are summarized in Table 1. Of the 91 individuals with peri-oral piercing, 39 were male (42.8%) and 52 female (57.2%). The average age was 25.13 years with a range of 20–43 years of age and a SD of 3.69 years. The 54 individuals in the non-pierced group had an average age of 25.78 years, with the age range identical to that of the pierced group and a SD of 3.99 years. A much higher prevalence of smoking was noted in the pierced group (46.2%) in comparison with the non-pierced group (18.5%). History of previous orthodontic treatment was similar between the two groups with 23.1% of the non-pierced group having had orthodontic treatment compared with 25.9% of the non-pierced group. A significant increase in the frequency and severity of gingival recession was noted between the two groups. Gingival recession on at least one tooth in the area directly opposed to the labret was noted in 68.13% of individuals in the pierced group as compared with 22.2% in the same gingival area in the non-pierced group. The severity of recession is markedly increased in the pierced group with 50.5% exhibiting Miller's class 1 recession compared with 22.2% in the non-pierced group. No recession defects greater than Miller's class 1 were noted in the non-pierced group, while 18.7% displayed Miller's class 2+ (which included the single instance of a Miller's class 3 in the pierced group) (Fig. 3). Individuals with piercing had been wearing their labrets continuously for a period of time ranging between 1 and 86 months, with 11.86 months, being the average. The SD was 16.4 months. Data clearly demonstrate that the longer the labret had been worn, the greater the cumulative prevalence and severity of recession that was noted (Fig. 4).

Chi-square tests of association between variables (Table 2), demonstrated a highly significant ($P < 0.001$) association between 'piercing status' and gingival recession. Notably, 'piercing elsewhere' was also found to have a significant ($P < 0.05$) association with gingival recession – to the extent that cross-tabulating 'piercing elsewhere' with 'piercing status' and chi-square analysis demonstrated a sufficiently close association between the two ($P < 0.001$) as to render them almost interchangeable.

Notwithstanding such a close association of these two regressors, logistic regression analysis of the full sample of 145 individuals showed 'piercing status' to be the only member of the six predictors investigated that would be capable of making a statistically significant ($P < 0.05$) contribution to the model. Indeed, as shown in Table 4, 'piercing elsewhere' did not emerge as a significant predictor. Neither did sex, age, smoking, nor previous orthodontic experience.

The impact of peri-oral piercing with a labret on the gingival recession rate is confirmed by the relative risk and odds ratio calculations presented in Table 3. The odds ratio of 7.487 indicates that gingival recession is almost 7.5 times as likely in a pierced individual wearing a labret than in an unpierced individual.

Results of the ordinal regression analysis presented in Table 5 reflect any additional role that the characteristics of the labret jewelry might have in determining severity of recession, as represented by the ordinal categories of the Miller's classification. Using the 91 subjects who had undergone piercing and who were wearing labrets, five labret parameters have been included in addition to the five general parameters that were applied previously to the full model. It is clear from Table 5 that, of the 10 explanatory variables tested, 'previous orthodontics' was the only variable that was found to play a significant role ($P < 0.05$) as a predictor of Miller's category.

Table 6 provides a classification matrix to depict the model's ability to maximize the proportions of true positives and true negatives amongst a fully pierced group of individuals. Sensitivity, 87.3%; specificity, 32.14%; positive predictive value, 74.32% and negative predictive value, 52.94%. Owing to the necessity of having to collapse all the Miller's classes that had been coded above zero into a single positive category for purposes of the matrix, predictions within the sub-categories could not form part of the sensitivity computation. However, as shown in the bottom of Table 6, further breakdown of the 55 cases that had been correctly predicted as 'recessed' shows the model to have been a lot more successful in differentiating class 1 cases correctly than was the case with class 2+ cases, which it had demonstrated a strong tendency to under-predict as class 1.

Discussion

The values listed in Table 4 under the heading 'Exponents(B)' represent odds ratios of the individual predictor variables. These indicate the extent to which each of the predictors, when present, would modify the odds of gingival recession occurring. It is clear from the table that the majority of the variables listed would exert only a limited influence, with 'piercing status' alone being statistically significant. Indeed, 'piercing status', when present, would increase the odds of gingival recession occurring by 8.016. Considering this value in terms of the relationship of odds to probabilities, where $P = [\text{Odds}/(1+\text{Odds})]$, the quotient 8.016/9.016, would result in a value of $P = 0.889$. The inference of this is that the combination of labial piercing and a labret would on its own increase the risk of an individual developing gingival recession by 88.9%. This supports the hypothesis as stated.

The impact of labial piercing upon odds can be strikingly demonstrated by applying the representative parameters in Table 4 to the logistic equation. To take the illustrative example of a non-smoking 21-year-old male subject, without labial piercing (but with piercing elsewhere) and a previous history of orthodontic treatment, solving for z (the natural log of the odds $[P/(1-P)]$) would involve the summation of products of the relevant parameters with their coefficients from Table 4 as follows:

$$z = -3.139 + \overset{\text{age}}{(0.069 \times 21)} + \overset{\text{orthodontics}}{(0.791 \times 1)} + \overset{\text{piercing elsewhere}}{(0.255 \times 1)} = -0.644.$$

Taking the antilog $e^{-0.644}$ produces a value for the odds of recession occurring of 0.5252, which by algebraic manipulation $P = [\text{Odds}/(1+\text{Odds})]$, will result in a probability value of $P = 0.34$, or 34%. Modifying this profile through the incorporation of 'piercing status' into the equation will increase the value of z by (2.081×1) to 1.437. This would result in an exponent of $e^{1.437}$ and a corresponding increase in odds ratio to 4.2080. Solving for P as previously explained will result in a value of 0.808 indicating that such an individual, by electing to undergo labial piercing with provision of a labret, could increase the risk of his developing gingival recession from 34 to 80.8%.

Age, sex, smoking history and labret characteristics such as length of shaft, the labret's contact position on the tooth or gingiva, and soft tissue envelopment of the labret retaining disc are not significant risks for the development of recession in patients with lip piercing.

Conclusion

Health professionals need to be made aware of the risk associated with elective oral piercing in order to advise their patients contemplating facial piercing or to manage postpiercing complications. As both tongue and lip piercing become more prevalent, an increasing number of complications will be encountered. This study clearly identifies the presence of a labret in a pierced peri-oral site as a significant risk factor for gingival recession regardless of the patient's age, gender, or the position and configuration of the labret. Furthermore, an increase in incidence and severity has been demonstrated according to the length of time the labret has been worn. There is a move amongst commercial piercing providers to establish standards of infection control and piercing protocol (14), and this is to be

commended. Still being propounded, however, are anecdotal beliefs that judicious placement of the labret, with appropriate shaft length and retaining disc resting on tooth structure rather than gingivae, will somehow preclude gingival recession from occurring. Our study has shown that these beliefs are scientifically unfounded and clearly incorrect. Consequently, patients who are contemplating this treatment should be advised of the significant risk of gingival recession that the provision of a labret, *per se*, is likely to provoke.

References

1. Lovegrove J, Leichter J. Exposed root surface: a review of aetiology, management and evidence-based outcomes of treatment. N Z Dent J 2004;100:72–81.
2. Cheong YH. The fading links between tradition and oral health in Singapore. Int Dent J 1984;34:253–6.
3. Greif J, Hewitt W, Armstrong ML. Tattooing and body piercing. Body art practices among college students. Clin Nurs Res 1999;8:368–85.
4. Hoffman-Axthelm W. History of dentistry. Chicago: Quintessence Publishing Co.; 1981. p. 52–58.
5. Ring M. Dentistry: an illustrated history. New York: Harry N Abrams Inc.; 1985. p. 2–24.
6. Er N, Özkavaf A, Berberoğlu A, Yamalik N. An unusual cause of gingival recession: oral piercing. J Periodontol 2000;71:1767–9.
7. Farah CS, Harmon D. Tongue piercing: case report and review of current practice. Aust Dent J 1998;43:387–9.
8. Fehrenbach MJ. Tongue piercing and potential oral complications. J Dent Hyg 1998;72:23–25.
9. Scully C, Chen M. Tongue piercing (oral body art). Br J Oral Maxillofac Surg 1994;32:37–38.
10. DiAngelis AJ. The lingual barbell: a new etiology for the cracked-tooth syndrome. J Am Dent Assoc 1997;128:1438–9
11. Price S, Lewis M. Body piercing involving oral sites. J Am Dent Assoc 1997;128:1017–20.
12. Peticolas T, Tilliss TS, Cross-Poline GN. Oral and perioral piercing: a unique form of self-expression. J Contemp Dent Pract 2000;1:30–46.
13. Perkins CS, Meisner J, Harrison JM. A complication of tongue piercing. Br Dent J 1997;182:147–8.
14. Leichter JW, Lovegrove J, Murray C. Elective lip piercing and gingival recession: case report. N Z Dent J 2003;99:42–45.
15. Dibart S, DeFeo P, Surabiun G, Hart A, Capri D, Ming-Fun S. Oral piercing and gingival recession: review of the literature and a case report. Quintessence Int 2002;33:110–2.
16. O'Dwyer JJ, Holmes A. Gingival recession due to trauma caused by a lower lip stud. Br Dent J 1997;192:28–31.
17. Scardella A, Pedrazzini M, Bez C, Lodi G, Carrassi A. Labial piercing resulting in gingival recession. A case series. J Clin Periodontol 2002;29:961–3.
18. Brooks JK, Hooper KA, Reynolds MA. Formation of mucogingival defects associated with intraoral and perioral piercing. Case reports. J Am Dent Assoc 2003;134:837–43.
19. Miller PD. A classification of marginal tissue recession. Int J Periodontics Restor Dent 1985;5:8–13.
20. McCullagh P. Regression models for ordinal data. J R Statist Soc 1980;42:109–42.