Evaluation of the relationship among dental fear, scaling root planning and periodontal status using periodontitis stages⊠ a retrospective study

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Abstract

Background: The present study used the new classification of periodontitis and validated questionnaires to assess the relationship among dental fear, scaling and root planning (SRP) pain and periodontal status for clinical evaluation.   Methods: One hundred and twenty periodontitis patients were enrolled for retrospective analysis and staging according to the new classification of periodontitis. All patients included in this study from July 2018 to January 2020 were divided into periodontitis stages. Scaling and root planning (SRP) was performed and Visual analogue scale (VAS) was determined for every patient immediately after SRP. Application of questionnaires including Corah's Dental Anxiety Scales (DAS), Dental Fear Survey (DFS), and the short-form Dental Anxiety Inventory (S-DAI) were implemented from the first attendance and consequent visits after 6 months. All patient demographic data were collected including age, gender, marital status and education level. The scores of each dental fear scale and combination scales were also recorded. Patients were further subdivided into two categories based on DAS scores (low dental fear group: DAS<13; high dental fear group: DAS≥13). Statistical analysis was performed using t-test, chi-square, pearson and spearman correlative analysis to evaluate the relationship and differences among dental fear, SRP pain and periodontal status.   Results: Compared to pre-SRP treatment, dental fear level of DFS and combination scales were significantly decreased in the post-treatment period for all the periodontitis stages. There was no statistically significant difference between the pre-treatment and post-treatment periods on S-DAI and DAS in stage I and II; meanwhile, there were statistically significant differences between pre-treatment and post-treatment periods on S-DAI and DAS in stage III and IV. The correlation among periodontitis stages, VAS and dental fear level assessed via DAS, DFS and S-DAI, was statistically significant. In the categories divided according to DAS scale, the proportion of high periodontitis stages was significantly increased in high dental fear group (DAS≥13).   Conclusion: SRP can reduce dental fear level in all periodontitis stages, especially in stage III and IV. Correlations exists among periodontal status, dental fear and SRP pain. High dental fear is associated with poor periodontal status.

Background

Periodontal disease is one of the two most important oral diseases. Severe periodontal disease is the eleventh most prevalent disease worldwide and it may lead to tooth loss [1,2]. Non-surgical periodontal therapy including scaling and root planning (SRP) remains the gold standard of successful periodontal therapy [3]. SRP was found to be effective in reducing the probing depth and improving the clinical attachment level [4, 5]. However, the resulting pain and sensitivity during treatment would discourage patient attendance and increase dental fear level [6].

Dental fear affects 5-20% of adults globally and ranges from a mild sensation of apprehension to prominent fear and dental phobia [7-9]. Less frequent dental visits, poorer oral health and greater functional impairment were related to dental fear [10]. The dental fear level also negatively affects the treatment outcomes and even leads to avoidance of dental treatment [6,10]. It was found that individuals, who had high dental fear would delay treatment, leading to more extensive development of disease, which ultimately required more invasive and potentially painful treatment, and these experiences could then contribute to an increase in the dental fear: this is the idea of a 'vicious cycle'[11.12].

Patients with periodontal disease had higher dental fear levels [13]. Continuously high levels of dental fear caused by discomfort or pain experienced during the periodontal treatment process might have negative effects on the clinical outcome [14]. Pain per se or the memory of pain was proved to be the stimuli inducing dental fear during periodontal treatment [15-17]. Psychological stability was deemed beneficial in terms of reducing post-treatment pain and life activities impairment degree [18]. Sites of bleeding on probing (BOP) and sites≥4 mm probing depth also caused higher VAS scores [19]. Correlation among dental fear, SRP pain and periodontal status was established.

The relationship among dental fear, pain and periodontal status assessed using previous periodontal disease classification (1999) was reported [20.21]. According to Santuchi et al, patients with mild to moderate chronic periodontitis based on the previous classification (1999) exhibited worse clinical periodontal status with higher dental fear level [13]. Schirme et al reported that severe periodontal inflammation (≥4 sites with≥6 mm PD) was related to pain and dental fear during SRP[20]. Levin et al noted that patients with aggressive periodontitis (AgP) in previous classification (1999) demonstrated higher dental fear levels [8]. In 2018, researchers revisited previous classification (1999), incorporated new knowledge relevant to its epidemiology, etiology and pathogenesis that has accumulated since the current classification's inception, and then proposed a novel classification framework along with case definitions. The new classification assessed periodontitis by stages and grades. Staging based on the severity of disease presented the complexity of disease management, while grading provided supplemental information about biological features of the disease [22]. Graetz et al and Karaaslan et al stated that periodontal status assessed by new periodontitis classification (2018) was associated with oral health-related quality of life (OHRQoL) [23.24]. Moreover, Petit et al reported that increase stress, anxiety and depression could worsen SRP outcomes in periodontitis stage III and IV [25]. The new periodontitis classification (2018) was widely used in clinical assessment, but research on dental fear and SRP pain was insufficient.

The present study used the new classification of periodontitis and validated questionnaires to assess the relationship among dental fear, SRP pain and periodontal status for clinical evaluation.

Methods

Study design and population

Patients who presented at the Outpatient Clinic of Stomatological Hospital, Southern Medical University from July 2018 to January 2020, were chosen to perform the questionnaires. Written informed consent for participation was obtained from all participants prior to the investigation. This study was approved by the Ethical Committee, Stomatological Hospital of Southern Medical University (Ethical approval number 2019-35).

The following inclusion criteria were adopted: 1. diagnosis as periodontitis （American Academy of Periodontology）AAP）2018）[22]; 2. aged 35–65 years old; 3. at least 4 natural teeth per quadrant (one incisor, one canine, one premolar and one molar) with healthy pulp status; 4. no dentin hypersensitivity. Exclusion criteria were: 1. periodontal treatment including scaling and root planing procedures within 12 months. 2. utilization of antibiotics or anti-inflammatory drugs within 1 month; 3. use desensitizing toothpaste within 1 month; 4. pregnancy and lactation; 5. history indicative of a medical or psychological disorder that may affect normal pain perception, or taking any stress or pain medication; 6. smoking or alcohol abuse; 7. systemic disease.

Study procedure

The new classification of periodontal disease (2018) provided an assessment of periodontitis in stages and grades [22]. Stages parameters included interdental clinical attachment loss, probing depth, radiographic bone loss and tooth loss. Stage I: Interdental CAL 1-2 mm, maximum PD≤4mm, radiographic bone loss less than 15% coronal third of the tooth, no tooth loss; Stage II: Interdental CAL 3-4 mm, maximum PD≤5mm, radiographic bone loss of up to 15% to 33% coronal third of the tooth, no tooth loss; Stage III: Interdental CAL≥5 mm, PD≥6mm, radiographic bone loss extending to mid-third of root and beyond, less than 4 teeth loss; Stage IV: Interdental CAL ≥5 mm, PD≥6mm, radiographic bone loss extending to mid-third of root and beyond, more than 5 teeth loss, with or without loss of masticatory function. Grades were used as indicators of the progression rate of periodontitis. Smoking and diabetes were parameters evaluating the grade level. However, these factors were excluded in the current study. In this case, we did not integrate grading into population assessment. All patients who presented from July 2018 to January 2020 were divided into periodontitis stages. In each stage, the data of continuous thirty patients were recorded. A total amount of one hundred and twenty patients demographic data were collected in this study. Periodontal examination including probing depth (PD）clinical attachment level (CAL) and radiographic inspection was conducted at the first visit. Measurements of PD and CAL were obtained at six sites per tooth in all present teeth. After periodontal examination, scaling and root planning (SRP) was performed with Gracey curettes until the root surfaces were hard and smooth. The VAS scale was applied immediately after SRP treatment. DAS, DFS and S-DAI questionnaires were implemented from the first attendance and consequent visits after 6 months. Every procedure was carried out by one doctor and without previous analgesics.

Questionnaires DAS, DFS and S-DAI

Prior to the procedure, the patient was interviewed using the questionnaires to gather information enabling to assess the dental fear level. The questionnaire comprised 3 separated tests: Corah's Dental Anxiety Scales (DAS), Dental Fear Survey (DFS), and the short-form Dental Anxiety Inventory (S-DAI). The questionnaire was composed of 33 multiple-choice questions in total. The DAS consisted of four questions related to concerns on visiting the dentist [26], with the first two questions relating to general anxiety and the last two questions relating to anticipated fear of any specific stimuli. A score of 13 or above on the DAS was defined as "high dental fear", as widely accepted on previous assessments [27]. The DAS was the most extensively used dental fear scale for adults, which demonstrated adequate reliability and validity. Nonetheless, it failed to provide additional information regarding what the patient specifically fears. Dental Fear Survey (DFS) consisted of 20 items with five alternative answers to each one of them, rated from high to low intensity, covering the patients' specific fears [28, 29]. S-DAI was established by Stouthard et al [25], and it contained 9 items. S-DAI allowed for assessment of physical reactions, thoughts and behavioral aspects of dental fear experienced by the individual [31]. DFS and S-DAI both had good reliability and validity tested Chinese version [32, 33].

General information besides questionnaire contained social-demographic features including gender, age, education level and marital status. Education level was divided into three types which were "Under Junior high school" (recorded as point 1), "High school" (recorded as point 2) and "College or over" (recorded as point 3). Marital status was recorded either as Unmarried (recorded as status 1) or Married (recorded as status 2).

Visual Analogue Scale

Pain level was evaluated by Visual analogue scales (VAS). This scale is the most frequently used method to assess pain intensity. It consists of a horizontal line labelled at each end from 0 to 10 cm, where individuals mark their level of pain[34, 36]. VAS was applied in a standard manner with an initial explanation to the patients clarifying that 0 means no pain and discomfort, while 10 represents an extremely intense pain and discomfort [14]. VAS score was performed immediately after the scaling and root planing (SRP) treatment.

Data analysis

T-test was used to analyze the differences of dental fear pre- and post-SRP treatment. Pearson and Spearman correlative analysis were used to analyze correlation among dental fear values, VAS and periodontitis stages. Chi-square was performed to evaluate the severity of periodontitis in patients with different dental fear levels. For all statistical analysis, *P* values were two-tailed and the level of significance was set at *P*<0.05.

Results

The current study retrospectively analyzed 120 periodontitis patients with average age 43.3±5.98 including 64 males (53.33%) and 56 females (46.67%). According to the periodontal status, all patients were divided into 4 stage groups. No significant differences were elicited across the patients groups with respect to age, gender, educational level and marital status（P > 0.05）. Periodontal indicators and background characteristics were illustrated in Table 1.

From the dental fear questionnaires, compared to pre-SRP treatment, dental fear level of DFS and combination scales were significantly decreased in the post-treatment period for all the periodontitis stages. There were no statistical significant differences between the pre-treatment and post-treatment periods on S-DAI and DAS in stage I and II; meanwhile, there were statistical significant differences between pre-treatment and post-treatment periods on S-DAI and DAS in stage III and IV. (Table 2)

The results of correlative analysis revealed the relationship among dental fear, VAS and periodontitis stages in Table 3. Correlation was statistically significant for dental fear levels assessing DAS, DFS and S-DAI, VAS and periodontitis stage. Correlation among periodontitis stages, VAS and dental fear level assessed via DAS, DFS and S-DAI, was statistically significant.

High dental fear was defined by a score of 13 or above on the DAS scale, as widely accepted previously [22]. We separated the patients into two categories, which were low dental fear group (DAS<13) and high dental fear group (DAS≥13). Group A patients consisted of 2 (6.45%), 5 (16.13%), 11 (35.48%) and 13 (41.94%) patients in stage I, stage II, stage III and stage IV, respectively. Whereas Group B patients comprised 28 （31.46%）, 25 (28.09%), 19 (21.35%) and 17 (19.10%) patients in stage I, stage II, stage III and stage IV. In the categories divided according to DAS scale, the proportion of high periodontitis stages was significantly increased in high dental fear group (DAS≥13). (Figure 1)

Discussion

In this study, the new 2018 periodontitis classification and validated questionnaires were used to determine the relationship among dental fear, SRP pain and periodontal status.

The previous 1999 periodontitis classification was used extensively, but its major drawbacks were substantial overlap and lack of clear pathobiology-based distinction [22]. Whereas, the new classification provides an assessment of periodontitis on the basis of stages and grades [22]. Participants of this study had no systemic disease and smoking history, and the follow-up visits were set as 6 months following therapy. In this case, we did not include grading into the population assessment.

Dental fear should be studied with regard to the situation to which it pertains, the reactions it evokes, and its duration [13]. This study used DAS, DFS and S-DAI to evaluate dental fear from various aspects. DFS reflects dental fear informatively, which assists clinicians in obtaining a better understanding of the patient's fear, while DAS measures dental fear in a more general manner [36]. Meanwhile S-DAI focuses on psychometric grounds [30], with nearly half of its items representing the emotional reactions of patients with respect to dental treatment [13, 36]. Santuchi et al reported significantly lower dental fear levels at the first attendances as suggested by DAS, but no statistical significance on DFS [14]. Thus, researchers draw different conclusions towards the same issue based on their analyses of different scales. In the current study, the scores obtained from DAS and S-DAI were significantly decreased at the subsequent visits 6 months in most scales, but changes in DAS and S-DAI scores were not significant in stage I and II. Even though there was a discrepancy in the statistical significance of each scale, the combination of three dental fear scales was consistently decreased at the subsequent visit 6 months later, and the mean values of all the scales also declined. In this case, this study established a combination of three scales for analysis, which could enhance the accuracy of the results.

Notably, the present study demonstrated correlations between periodontitis stages and dental fear. Periodontal status was an important factor affecting dental fear, since worse periodontal status were found to contribute to higher dental fear level [13]. Guentsch et al suggested that patients with higher dental fear levels experienced more bleeding on probing (BoP), which had negative effects on periodontal health [37]. Levin et al proved that periodontal clinical parameters, including plaque index, radiographic bone loss and probing depth were correlated with DAS [8]. Bell et al reported that dental fear was associated with bleeding gums as a sign of gingivitis [38]. Notwithstanding, controversial opinions still exist. Delgado-Angulo et al concluded that dental fear was not related to the number of teeth with PD≧4mm[21], meanwhile Eitner et al stipulated that anxiety was not associated with periodontal status[39]. These differences in dental fear levels may be attributed to the high variability of periodontal parameters, so the new classification is perfectly habilitated to avoid the uncertainty due to indicators.

Pain is an 'unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described by the patient in terms of such damage' [40]. As a major component of dental fear, fear of pain associated with dental treatment was identified [41]. SRP is often associated with pain and discomfort, albeit the occurrence of pain is variable and dramatically different among patients [20]. The VAS scores representing the pain perceived during periodontal procedures range from approximately 20-80mm [42, 43]. In this study, the VAS during SRP was 24.79±14.61, which was significantly associated with dental fear. Tickle et al discovered that subjects with dental fear were 2.3 times more likely to experience pain after dental treatment [44]. Fardal et al and Staunton et al drew a similar conclusion on various aspects of focus [45,46].

Based on these facts, Schirme et al suggested that periodontal treatment should encourage healthcare professionals to design health and comfort treatment strategies that will cope with the dental fear of patients and reduce discomfort during dental treatment [20]. On the other hand, Kyle et al and Eli et al reported that patients reported less pain during treatment than they predicted [47,48]. Therefore, evaluation of dental fear and pain levels is crucial for a successful periodontal treatment.

In the present study, a statistically significant correlation was identified among dental fear, pain and periodontal status. The dental fear levels were all reduced across every stage of periodontitis patient, especially in stage III and IV, which highlighted the necessity of treatment intervention. Santuchi et al reported that periodontal status was improved and experiences of fear were reduced during SRP, which was similar to our study [14]. Fardal et al reported that anxiety levels decreased with the progress of the periodontal therapy [49]. Consequently, clinicians should notice the level of dental fear and break the 'vicious cycle' in periodontitis patients [11,12].

The proportion of patients with periodontitis stage III (35.48%) and IV 41.94% in high dental fear group was significantly increased compared to those in low dental fear group (stage III 21.34%, stage IV 19.10%). Despite the fact that the dental fear level of patients were reduced at the 6 months return visit, the dental fear values were still high, especially in stage III and IV. Stage I and II were considered to initial and moderate periodontitis, while stage III and IV were severe and advanced periodontitis [50]. This was in accordance with the findings in other studies demonstrating that patients with severe periodontitis had poorer oral health, worse functional limitation, physical pain, and psychological incapacity domain scores, in comparison to those with mild and moderate periodontitis [51]. Based on the results of our study, clinician should pay more attention to dental fear in stage III and IV periodontitis patients.

This is the first study in the literature to measure the periodontal status based on periodontitis stages, aiming to evaluate the relationship between dental fear and pain. It is worth mentioning that our study comprises several limitations. For starters, the population size of the current study was relatively small although statistically sufficient. Secondly, lack of inter-rater reliability restricted the precision of the current study. Finally, grading assessment in the future study should incorporate a clinical evaluation of new periodontitis classification.

Conclusions

SRP can reduce dental fear level in all periodontitis stages, especially in stage III and IV. Correlations exists among periodontal status, dental fear and SRP pain. High dental fear is associated with poor periodontal status.

Abbreviations

SRP: scaling and root planing; VAS: Visual Analogue Scale; DAS: Corach's Dental Anxiety Scales; DFS: Dental Fear Survey; S-DAI: short-form Dental Anxiety Inventory; BOP: bleeding on probing; PD: probing depth CAL clinical attachment level

Declarations

Ethics approval and consent to participate

The present study was approved by the Ethical Committee, Stomatological Hospital of Southern Medical University. Written informed consent for participation was obtained from all participants prior to the investigation

Consent for publication

Not applicable

Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

LYY carried out the study implementing and drafted the manuscript. ZCM and WJY contributed with statistical analysis. YHM and XDL participated in data analysis and interpretation of data revised critically. XCJ conceived of the study, and participated in its design and coordination and helped to draft the manuscript. All authors read and approved the final version of the manuscript.

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Tables

Table 1 Periodontal indicators and demographics of four periodontitis stages

Periodontitis Stage	Stage I n=30	Stage II n=30	Stage III n=30	Stage IV n=30	P
Age	41.70±5.96	43.17±4.78	43.33±6.09	45.13±6.72	0.173
Gender (M:F)	14:16	15:15	17:13	16:14	0.885
Marriage	83.33%	86.67%	83.33%	80.00%	0.983
Education	2.73±0.45	2.67±0.48	2.57±0.50	2.53±0.63	0.426
PD	2.28±0.18	2.46±0.24	3.72±0.23	3.86±0.32	<0.001
CAL	1.67±0.19	2.72±0.25	3.82±0.27	4.13±0.36	<0.001

, Probing Depth; CAL, Clinical Attachment Level; Stage I: periodontitis stage I, Stage II: periodontitis stage II, Stage III: riodontitis stage III, Stage IV: periodontitis stage IV; n: number.

atistical test: chi-square test

Table 2 Comparative analysis of dental fear between pre- and post-SRP in four periodontitis stages

	DAS		DFS		S-DAI		Combination	
	pre-SRP	post-SRP	pre-SRP	post-SRP	pre-SRP	post-SRP	pre-SRP	post-SRP
I	9.17 ±1.98	8.20±2.06	38.03±5.89	34.70±6.20*	21.40±6.79	18.63±5.90	68.60±10.29	61.53±9.56*
II	10.77±3.00	9.07±3.67	45.03±14.88	37.63±11.89*	26.53±9.17	23.43±9.02	82.33±19.75	70.13±17.04*
III	11.10±4.16	8.97±3.97*	48.93±16.47	40.13±13.87*	27.97±9.69	22.83±9.14*	88.00±19.50	71.93±15.92*
IV	12.03±4.06	9.57±3.89*	54.87±18.44	42.30±15.94*	30.63±7.92	24.47±8.23*	97.53±21.65	76.33±20.28*

*: Compared to Pre-SRP, Significantly different, $P<0.05$

Combination=DAS+DFS+S-DAI

DAS: Corach's Dental Anxiety Scales, DFS: Dental Fear Survey, S-DAI: short-form Dental Anxiety Inventory; I: periodontitis stage I, II: periodontitis stage II, III: periodontitis stage III, IV: periodontitis stage IV.

Statistical test: two independent t-test

Table 3 Correlation among periodontitis stage, dental fear and VAS

	VAS	periodontitis stage
DAS	0.531**	0.281*
DFS	0.476**	0.380**
S-DAI	0.200*	0.375**
Combination	0.533**	0.493**

*:$P<0.05$, **:$P<0.01$

Combination=DAS+DFS+S-DAI

DAS:Corach's Dental Anxiety Scales, DFS:Dental Fear Survey, S-DAI: short-form Dental Anxiety Inventory.

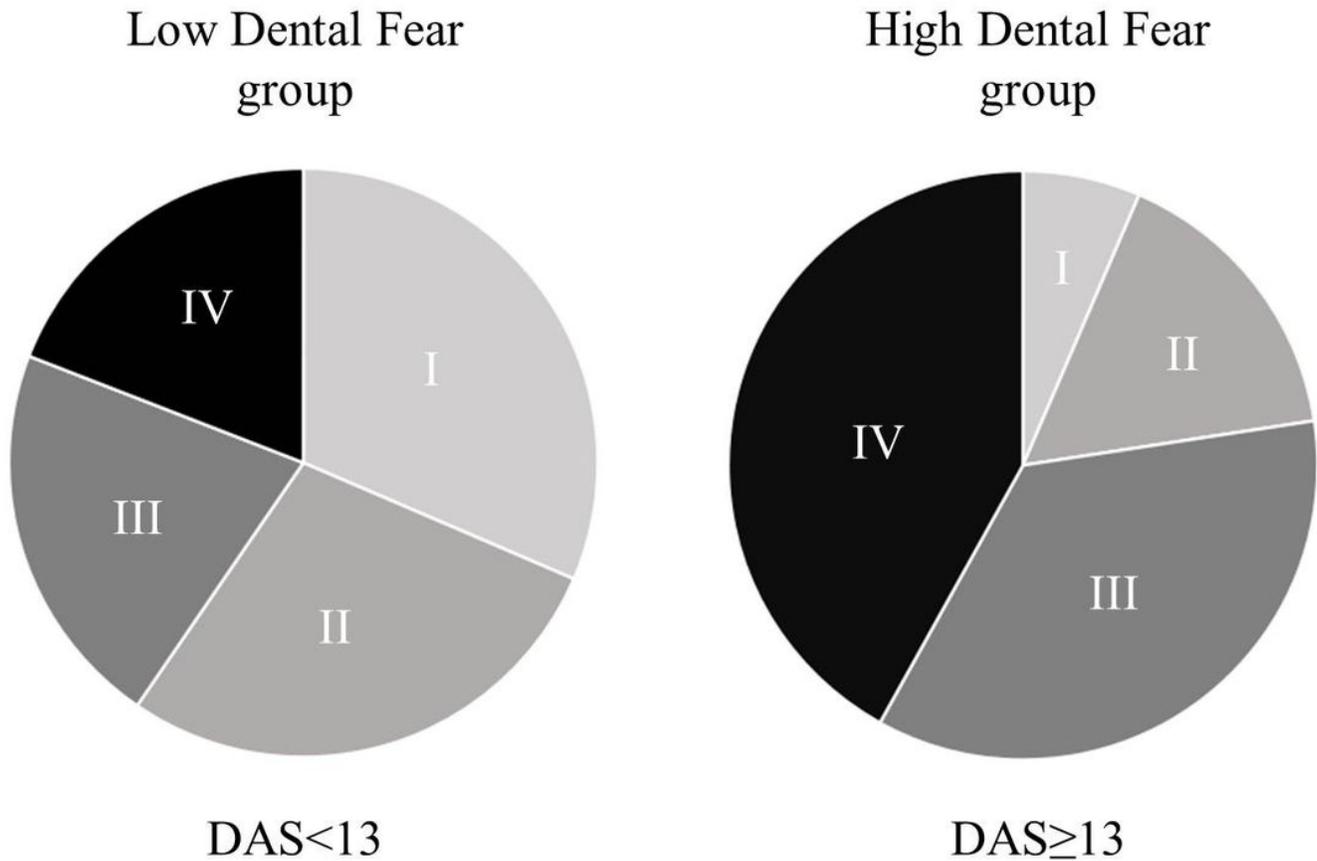Statistical test: Pearson and Spearman correlative test

Figures

Low Dental Fear group — DAS<13

High Dental Fear group — DAS≥13

Figure 1

Distribution of the periodontitis stages between low ad high dental fear groups.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SupplementalTable.docx