

# Concordance Among Different Pain Scales in Patients with Dental Pain

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***Aims:** To evaluate the concordance among different pain scales for evaluation of pain in toothache patients and to assess the influence of oral health on the quality of life of those patients. **Methods:** Ninety-two patients seeking treatment for toothache were evaluated before and after treatment. At baseline and 1 week after the dental treatment, the patients were requested to fill out the Oral Health Impact Profile Inventory (OHIP-14) as well as the following pain scales: the visual analog scale (VAS), numeric scale (NS), verbal rating scale (VRS), and Faces Pain Scale-Revised (FPS-R). The data were analyzed by Pearson correlation, Student t test, and analysis of variance for repeated measurements, with a significance level of 5%. **Results:** Patients were, on average, 34.4 years old. The sample was composed of 50 women and 42 men. Fifty-eight patients had dental pain of pulpal origin, and 34 had pain of periodontal origin. The mean OHIP score was 20.83 at baseline and 5.0 at 1 week after the completion of the dental treatment. The mean values of the scales at baseline were 50.7 mm, 56.7 mm, 52.2 mm, and 52.9 mm for the VAS, NS, VRS, and FPS-R, respectively. One week after the treatment, these values were 7.5 mm, 9.4 mm, 10.9 mm, and 8.7 mm. A positive correlation was detected between all four scales at baseline and also 1 week after the treatment ( $P < .05$ ). At baseline, the NS was significantly different from the other scales. This difference, however, was not detected at the end of the trial. **Conclusion:** All scales were able to detect differences in the pain reported after dental treatment and may be valid and reliable for use in clinical dental practice. The NS, however, returns higher scores at baseline when assessing the pain.*

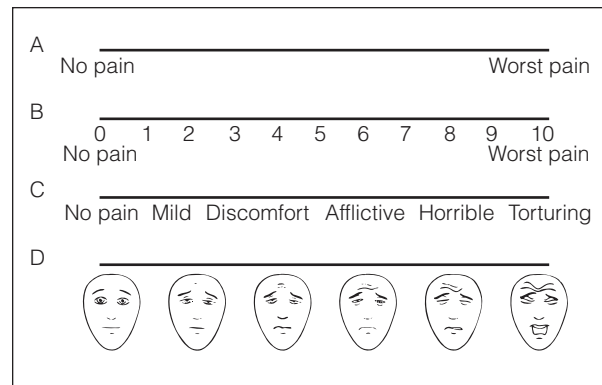
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**Key words:** pain assessment, pain intensity, pain scale, quality of life, toothache

It has been stated<sup>1</sup> that almost 22% of the US civilian population has experienced at least one type of orofacial pain, the most prevalent type of pain being toothache, which occurs in 12.2% of these individuals (more than 22 million people). Dental pain of pulpal and periodontal origins is characterized by the presence of an inflammatory component.<sup>2</sup>

Several methods for the assessment of pain have been described, including inventories and scales. Amongst the scales for measuring pain intensity, the visual analog scale (VAS), numeric scale (NS), and verbal rating scale (VRS) are those most often used in clinical research and in pain surveys.<sup>3,4</sup> Also, many instruments have been designed to measure the impact of oral health on the quality of life. The Oral Health Impact Profile (OHIP) and its short form, the OHIP-14, are widely used.<sup>5,6</sup> The OHIP is an instrument that measures the subject's

**Fig 1** (A) VAS; (B) NS; (C) VRS; (D) FPS-R. (FPS-R reprinted with permission from Hicks CL, von Baeyer CL, Spafford PA, van Korlaar I, Goodenough B. The Faces Pain Scale–Revised: Toward a common metric in pediatric pain measurement. *Pain* 2001;93:173–183 [with instructions as found on the author’s website: www.painsourcebook.ca.]



perception of the social impact of oral disorders on his or her well-being.<sup>5,7-9</sup> The OHIP-14 contains questions that retain the original conceptual dimensions contained in the OHIP, and the questions have a good distribution of prevalence, which suggests that the instrument should be useful for quantifying the levels of impact on well-being.<sup>6,7</sup>

In the field of orofacial pain, many studies<sup>4,10-12</sup> have addressed the validity and reliability of pain scales for chronic musculoskeletal types of pain, where the patient is typically able to identify the level of pain. This information, in addition to other parameters, has been considered useful in judging the efficacy of pain management strategies. In the case of dental pain, however, little information is available.

Therefore, the aims of this study were to evaluate the concordance among different pain scales for evaluation of pain in toothache patients and to assess the influence of oral health on the quality of life of those patients.

## Materials and Methods

### Subjects

The subjects recruited for the study were patients seeking emergency dental care for facial pain at the Bauru School of Dentistry, Brazil. Informed consent was obtained from each patient in accordance with the guidelines of the Research Ethics Committee.

This study included patients diagnosed with pain of dental origin (pulpal or periodontal) and thus excluded patients with pain of other origins or those who had previously undergone urgent dental treatment.

Over a period of 6 months, 50 women and 50 men aged 16 to 70 years were consecutively included in this study. Eight male patients were excluded from the survey because of erroneous marking on the scales or incorrect completion of the OHIP.

### Assessment

At baseline, when the individuals had their first appointment at the emergency dental care center, all subjects were examined by a clinician to determine the exact source of the pain and to confirm that there was a dental pathophysiologic state (pulpal or periodontal pain) compatible with the chief complaint. After the confirmation, the subjects were asked to indicate their individual representation of pain on the following 100-mm pain scales: the VAS (Fig 1a), NS (Fig 1b), VRS (Fig 1c), and Faces Pain Scale–Revised (FPS-R) (Fig 1d). The scales were self-administered, always in this order, and the patients were asked to place a vertical mark through each scale as appropriate for their pain at that moment. The position of the mark was subsequently measured to the nearest millimeter from the left end of the scale.

The subjects were also requested to fill out the short-form OHIP-14 (Table 1). They were asked if they had very often (coded 4), fairly often (coded 3), occasionally (coded 2), hardly ever (coded 1), or never (coded 0) experienced any of the problems assessed by the 14-item OHIP in the previous week.

The patients were then referred for dental treatment at Bauru School of Dentistry Emergency Dental Care Center. The follow-up visit occurred 1 week after the emergency dental treatment, when the patients were again requested to fill out the same scales and the OHIP-14.

### Data Analysis

The Pearson correlation and repeated-measures analysis of variance (RM ANOVA) were used to determine the concordance among the pain scale scores for the different scales. Student *t* test was used to investigate the influence of the pain origin and gender on the individual’s quality of life, whereas the two-way ANOVAs were used to compare baseline

Table 1 OHIP-14

In the last week, how frequently did you experience the following problems?

1. Have you had trouble *pronouncing any words* because of problems with your teeth, mouth, or dentures?
2. Have you felt that your *sense of taste* has worsened because of problems with your teeth, mouth, or dentures?
3. Have you had *painful aching* in your mouth?
4. Have you found it *uncomfortable to eat any foods* because of problems with your teeth, mouth, or dentures?
5. Have you been *self-conscious* because of your teeth, mouth, or dentures?
6. Have you *felt tense* because of problems with your teeth, mouth, or dentures?
7. Has your *diet been unsatisfactory* because of problems with your teeth, mouth, or dentures?
8. Have you had to *interrupt meals* because of problems with your teeth, mouth, or dentures?
9. Have you found it *difficult to relax* because of problems with your teeth, mouth, or dentures?
10. Have you been a bit *embarrassed* because of problems with your teeth, mouth, or dentures?
11. Have you been a bit *irritable with other people* because of problems with your teeth, mouth, or dentures?
12. Have you had *difficulty doing your usual jobs* because of problems with your teeth, mouth, or dentures?
13. Have you felt that life in general was *less satisfying* because of problems with your teeth, mouth, or dentures?
14. Have you been *totally unable to function* because of problems with your teeth, mouth, or dentures?

\*Responses are made on a five-point scale, coded 0 = never, 1 = hardly ever, 2 = occasionally, 3 = fairly often, 4 = very often.

Table 2 Mean ( $\pm$  SD) Scores of the VAS, NS, VRS, FPS-R, and OHIP-14 According to Gender at Baseline

Gender	VAS	NS	VRS	FPS-R	OHIP-14
Male*	47.2 $\pm$ 22.6	52.1 $\pm$ 25.0	52.2 $\pm$ 22.7	49.7 $\pm$ 22.5	20.4 $\pm$ 9.4
Female†	53.7 $\pm$ 19.7	60.6 $\pm$ 20.0	53.4 $\pm$ 20.2	54.4 $\pm$ 22.4	21.2 $\pm$ 8.0
Total	50.7 $\pm$ 21.2	56.7 $\pm$ 22.7	52.9 $\pm$ 21.2	52.2 $\pm$ 22.4	20.83 $\pm$ 8.6
P value	.15	.08	.78	.33	.67

\*n = 42; †n = 50.

Table 3 Mean ( $\pm$  SD) Scores of the VAS, NS, VRS, FPS-R, and OHIP-14 According to Gender at the Follow-up Visit

Gender	VAS	NS	VRS	FPS-R	OHIP-14
Male*	2.2 $\pm$ 4.2	3.1 $\pm$ 5.5	4.2 $\pm$ 7.7	6.3 $\pm$ 9.0	3.1 $\pm$ 3.8
Female†	13.1 $\pm$ 22.5	16.0 $\pm$ 25.7	13.5 $\pm$ 22.2	15.8 $\pm$ 22.0	7.0 $\pm$ 7.7
Total	7.5 $\pm$ 16.9	9.4 $\pm$ 19.5	8.7 $\pm$ 17.1	10.9 $\pm$ 17.3	5.0 $\pm$ 6.3
P value	.02	.02	.049	.048	.02

\*n = 26; †n = 25.

and follow-up scores. The statistical analyses were performed using Statistica for Windows version 5.1 software. A significance level of 5% was adopted.

## Results

Among the 92 patients assessed at baseline, 58 (63%) had dental pain of pulpal origin, whereas the other 34 (37%) were diagnosed as having pain of periodontal origin. The mean ( $\pm$  SD) age of the sample was 34.4  $\pm$  12.9 years.

The mean scores at baseline for the VAS, NS, VRS, and FPS-R are described in Table 2. Pearson correlation test showed a correlation among all of the scales ( $P < .001$ ). However, the RM ANOVA detected a significantly higher score for NS compared with the scores for the other scales ( $P < .001$  for the comparison with the VAS and VRS and  $P = .03$  for the comparison with the FPS-R).

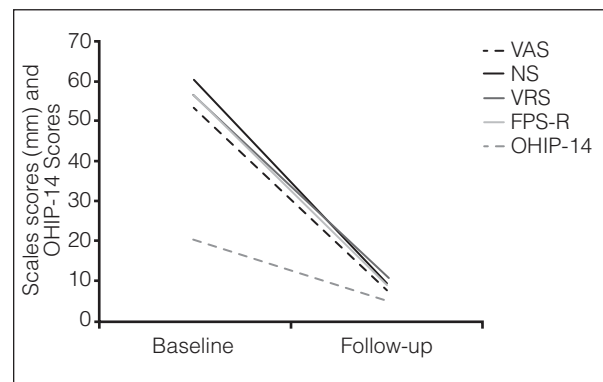
Forty-one patients withdrew from the study and did not participate in the follow-up. The mean scores for the VAS, NS, VRS, and FPS-R at the follow-up are described in Table 3. Pearson correlation test showed

**Table 4** Mean ( $\pm$  SD) Scores of the VAS, NS, VRS, FPS-R, and OHIP-14 According to Pain Origin at Baseline and the Follow-up Visit

Pain origin	VAS	NS	VRS	FPS-R	OHIP-14
Baseline					
Pulpal*	52.9 $\pm$ 23.5	57.8 $\pm$ 24.6	55.5 $\pm$ 22.9	55.7 $\pm$ 23.6	20.8 $\pm$ 8.9
Periodontal†	47.1 $\pm$ 16.4	55.0 $\pm$ 19.3	48.4 $\pm$ 17.6	46.3 $\pm$ 19.2	20.9 $\pm$ 8.2
<i>P</i> value	.21	.58	.12	.05	.92
Follow-up visit					
Pulpal‡	6.6 $\pm$ 15.8	7.9 $\pm$ 17.9	7.6 $\pm$ 15.9	10.6 $\pm$ 16.9	4.2 $\pm$ 6.1
Periodontal§	9.4 $\pm$ 18.9	8.4 $\pm$ 22.2	11.1 $\pm$ 19.3	11.6 $\pm$ 18.3	6.8 $\pm$ 6.3
<i>P</i> value	.59	.45	.49	.84	.17

\*n = 58; †n = 34; ‡n = 34; §n = 17.

**Fig 2** Reported pain scores on the VAS, NS, VRS, FPS-R, and OHIP-14 before and after emergency dental treatment.



a correlation among all of the scales ( $P < .001$ ). The RM ANOVA did not detect a significant difference among the scales ( $P = .059$ ). These results indicate an improvement of the individuals' pain on the order of 76.2%, 83.4%, 83.6%, and 79.1% for VAS, NS, VRS, and FPS-R, respectively.

The mean scores of the OHIP-14 at baseline and follow-up were  $20.83 \pm 8.6$  and  $5.0 \pm 6.3$ , respectively.

Gender did not influence the results at baseline ( $P > .05$ ); however, differences were found at the follow-up, when the values reported by the males were significantly lower for all scales analyzed ( $P < .05$ ) (Table 3).

The mean scores for the pain scales and the OHIP-14 at baseline and follow-up, according to the pain origin, are described in Table 4. Student *t* test showed that the pain origin (pulpal or periodontal) did not influence the results of the pain scales studied or the individuals' quality of life ( $P > .05$ ), either before or after the emergency dental treatment. Significantly higher values for all scales and OHIP scores were found at baseline compared with the follow-up visit ( $P < .001$ ). The pain scale scores and OHIP-14 scores for the entire sample are presented in Fig 2.

## Discussion

The results show a significant correlation among all scales studied. The possible influence of the order of completion of the scales, however, was not evaluated in the present investigation. These findings agree with most studies that consider these scales to be reliable and suitable for use in clinical practice.<sup>13-17</sup> They also agree with Hjermstad et al<sup>18</sup> who found in a systematic review that most of the reviewed papers were relatively consistent regarding the correlation between scales. They also found that the scales tended to change in the same direction.

Some studies have found the VAS and NS to be more sensitive than the VRS and FPS-R.<sup>13,19,20</sup> However, most patients prefer to communicate their pain in words rather than numbers.<sup>14</sup> The description of a sensation such as pain is difficult, especially when dealing with a condition that is difficult to locate such as toothaches of pulpal or periodontal etiology. The complex trigeminal system is frequently influenced by different neuronal inputs, which when combined with the individual's present psychosocial condition, makes it difficult to finally judge the level of pain based only on numbers. This difficulty was especially

apparent in the present study, where most of the subjects were diagnosed with pulpal pain (63%), which is a dichotomic condition and not a gradable situation, in contrast to musculoskeletal pain. Therefore, the choice of the scale will depend on the personal preference of the patients as well as on the ability of the patients to describe the sensation of pain that they are experiencing. Thus, as demonstrated by Miró et al<sup>21</sup> and Ware et al,<sup>22</sup> children and elderly persons prefer the FPS-R or even the VRS to measure the sensation of pain, whereas adults prefer the NS. Clark et al<sup>20</sup> found that patients with less education have a preference for the VRS.

Although a significant correlation between the scales was detected in the present study, Lund et al,<sup>4</sup> in a test-retest analysis, found discrepancies between the scales when the VAS was transformed to a scale of five equidistant categories similar to the VRS, which suggests that these scales produce data that are not interchangeable. Similar findings were reported by Ohnhaus and Adler.<sup>23</sup>

The validity of the VAS was established by Lara-Muñoz et al,<sup>15</sup> who tested the VAS, VRS, and NS in experimental conditions using a sound stimulus as a variable. It was concluded that the VRS provides more reliable scientific information, although most investigators<sup>18,23-25</sup> consider the VAS to be more sensitive because of its capacity to detect smaller variations in the intensity of pain. However, Downie et al<sup>13</sup> have stated a preference for the NS because the VRS offers only a few options whereas the VAS offers too many choices, which can make it confusing for patients. Holdgate et al<sup>19</sup> showed a significant correlation between the VAS and NS but also claimed that the minimum difference of 4 mm is sufficient to determine clinical changes in pain, which suggests that the VAS and NS cannot be used interchangeably. Differences of over 4 mm between the NS and VAS (56.7 and 50.7, respectively) were observed in our study, which agrees with the findings of Holdgate et al.<sup>19</sup>

Although Svensson,<sup>26</sup> Holdgate et al,<sup>19</sup> and Lund et al<sup>4</sup> have suggested that these scales are not interchangeable, some studies<sup>14,20</sup> have found that they have high reliability and can therefore be used in clinical practice. However, according to Clark et al,<sup>20</sup> the choice of scale should be made by the patient, always taking into account age, gender, and pain perception.

In this study, the pain of the patients improved considerably, regardless of the scale used. This expected improvement in pain levels explains the nonattendance of 41 patients at the follow-up examination, which somewhat compromised the results of this investigation. This loss of patients to

follow-up, along with the high variability of pain interpretation, may have resulted in the high variability (standard deviation) for the scores obtained at the follow-up visit.

Studies comparing pain scales and quality of life related to dental pain are uncommon in the literature. Thus, this study sought to estimate the impact of dental pain (pulpal or periodontal) on the quality of life, and the results revealed a considerable reduction in the OHIP-14 scores when the score before treatment (OHIP-14 = 20.83) was compared with the score after treatment (OHIP-14 = 5.00). This supports the hypothesis that dental pain affects the quality of life independently of the origin of the pain (ie, pulpal or periodontal).

Mariño et al<sup>6</sup> evaluated the impact of oral health on quality of life by applying the OHIP to a sample in southern Europe, and they found a significant association with gender (male patients reported a lower impact on oral health than females). These results agree with the study, where an association between gender and quality of life was found at the follow-up visit. According to Luo et al,<sup>27</sup> orofacial pain has a substantial detrimental impact on daily life activities, psychological distress, and quality of life.

Zheng et al<sup>28</sup> investigated the key factors associated with oral health-related quality of life in 200 adults with orofacial pain symptoms and found that patients with pain of dentoalveolar origin had a significantly higher mean OHIP score, which is consistent with the results of the present study, where the presence and intensity of pain influenced the quality of life. Similarly, the pain from temporomandibular disorders can also directly influence the quality of life, as described by Barros et al,<sup>29</sup> Reissmann et al,<sup>30</sup> and John et al.<sup>31</sup>

In conclusion, the dental pain assessment scales studied here (VAS, VRS, NS, and FPS-R) were highly correlated and therefore may be reliable and valid for use in clinical dental practice, although they are not interchangeable. There is no ideal scale for pain. The choice of pain scale should consider the patient's preference and, as stated in the literature, age and gender. Dental pain (pulpal or periodontal) seems to directly influence the quality of life.

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