Introduction Several studies have reported the occurrence of intraoral neuropathic pain conditions, which are often difficult to diagnose. Significant clinical characteristics of these conditions are somatosensory abnormalities.

The German Research Network on Neuropathic Pain (DFNS) developed a protocol with 13 quantitative sensory testing (QST) measures for detecting somatosensory abnormalities. Although reliability - an important aspect of a measure - has been found to be adequate for *cutaneous* QST, more information is needed to assess *intraoral* QST reliability.

Aim To investigate the inter- and intra-examiner reliability of 13 QST measures at intra- and extraoral sites.

Methods Twenty-one healthy volunteers from Malmö University, Malmö, Sweden (13 females and 8 males, mean age 40.4 years, range 24-71) participated. Two independent, blinded examiners who were calibrated in the DFNS QST protocol examined the participants using the entire protocol (**Table 1**; **Figure 2**). Each participant was examined twice on the same day - once by each examiner (inter-examiner reliability). After 1-2 weeks, one examiner re-examined all participants (intra-examiner reliability). The measurements were made on (**Figure 1**):

- 1) the skin of the right cheek
- 2) the tip of the tongue
- 3-4) bilaterally on the gingival mucosa of the upper premolar region

For all parameters except PHS, the intraclass correlation coefficient (ICC) was used to calculate reliability; for PHS, Cohen's kappa was used. Mean values and mean variation within each subject were calculated.

Figure 1. Orofacial measurepoints: 1) cheek 2) tip of tongue, 3-4) bilaterally on gingival mucosa, upper jaw premolar region.

Reliability of intraoral quantitative sensory testing (QST)

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Table 1. QST protocol according to the German Research Network on Neuropathic Pain (DFNS), and equipment used in this study. The tests are described in the order in which they are performed.

QST Protocol		
<i>Thermal testing</i>		
CDT	Cold detection threshold	MSA Thermotester (°C)
WDT	Warmth detection	
TSL	Thermal sensory limen	
PHS	Paradoxical heat sensations	
CPT	Cold pain threshold	
HPT	Heat pain threshold	
<i>Mechanical testing</i>		
MDT	Mechanical detection threshold	Von Frey filaments (mN)
MPT	Mechanical pain threshold	The PinPrick (mN)
MPS	Mechanical pain sensitivity	
DMA	Dynamical mechanical allodynia	Toothbrush, Q-tip, cotton wisp (mN)
WUR	Wind-up ratio	The PinPrick (mN)
VDT	Vibration detection threshold	Rydel-Seiffer tuning fork (64 Hz, 8/8 scale)
PPT	Pressure pain threshold	Pressure algometer (kPa)

Figure 2. Intraoral applications.

Results Most tests had acceptable to excellent inter-examiner (extraorally ICC=0.52 - 0.91, intraorally ICC=0.41-0.86 or kappa 0.34) and intra-examiner reliability (extraorally ICC=0.43 - 0.87, intraorally ICC=0.53 - 0.86 or kappa 0.25). Reliability for five QST measures was poor (ICC=-0.12 - 0.37). For the same test, inter- and intra-observer reliabilities at intra- and extraoral sites were similar. No significant differences between right and left sides were found intraorally. For specific results, see **Tables 2** and **3**.

Thermal testing: Cold (CPT) and heat pain threshold (HPT) had the highest reproducibility. PHS - a frequent finding intraorally (27%), although not on the tongue – had low reproducibility.

Mechanical testing: Reproducibility was highest for pressure pain threshold (PPT) and for mechanical pain threshold (MPT) and sensitivity (MPS). No healthy subject had dynamical mechanical allodynia (DMA), and ICC was low for all mechanical detection threshold (MDT) measurements, probably because the thresholds were often below the limit of detection of the instruments. The relatively small mean intraindividual variation (0.1 mN extraorally, 0.01mN on the tip of the tongue and 12.4mN on the upper premolar mucosa) indicates reasonable reproducibility.

Table 2. Intra- and inter-examiner reliability. ICC for all parameters except PHS, where Cohen's kappa was calculated.

Parameter	Intra-examiner (test-retest)		Inter-examiner	
	Extraoral	Tip of tongue	Extraoral	Tip of tongue
CDT	0.45	0.56	0.63	0.61
WDT	0.30	0.67	0.23	0.14
TSL	0.35	0.65	0.58	0.28
PHS	-	-	0.25	-
CPT	0.87	0.61	0.53	0.91
HPT	0.80	0.72	0.74	0.83
MDT	-0.12	-0.01	0.06	0.11
MPT	0.43	0.55	0.86	0.41
MPS	0.52	0.85	0.64	0.85
DMA	-	-	-	-
WUR	0.09	0.63	0.37	0.52
VDT	0.62	0.81	0.68	0.25
PPT	0.84	0.82	0.82	0.84
Excellent : ICC >0.75 or kappa >0.8				
Fair – good: ICC 0.4-0.75 or kappa 0.21 – 0.80				
Poor: ICC <0.4 or kappa ≤ 0.2				
- : Not experienced by any subject				

Table 3. Mean and SD for all continuous variables. All values in units according to Table 1.

	Extraoral	Tip of tongue	Regio 14
CDT	1.2 ± 0.6	4.2 ± 2.4	12.3 ± 7.7
WDT	1.8 ± 0.6	2.8 ± 1.3	9.3 ± 3.0
TSL	3.3 ± 1.1	6.5 ± 2.5	19.9 ± 7.5
CPT	18.4 ± 8.1	16.0 ± / 6.3	15.3 ± 7.6
HPT	41.5 ± 4.1	45.3 ± 3.1	47.9 ± 2.0
MDT	0.3 ± 0.1	0.3 ± 0.0	17.2 ± 14.9
MPT	208.3 ± 148.5	103.1 ± 68.4	294.8 ± 161.5
MPS	1.8 ± 2. 8	1.4 ± 0.9	0.5 ± 0.5
WUR	2.8 ± 2.9	2.4 ± 1.4	2.5 ± 2.2
VDT	6.3 ± 1.1	5.1 ± 1.2	6.4 ± 1.0
PPT	280.2 ± 85.8	118.0 ± 55.0	189.0 ± 67.3

The MSA Thermotester was used for temperature measurements. For CDT, WDT and TSL, the mean difference from baseline temperature (32°C extraorally, 37°C intraorally) is displayed. For CPT and HPT, pain threshold temperatures in °C are shown.

Conclusion Inter- and intra-examiner reliabilities of most QST measures according to the DFNS protocol* are acceptable for assessing somatosensory function in the orofacial region.

* Rolke R, Magerl W, Campbell KA, Schalber C, Caspari S, Birklein F, Treede RD. Quantitative sensory testing: a comprehensive protocol for clinical trials. Eur J Pain 2006;10:77-88.