Table 3 Mean prescription and mean imprecision values

		N	Mean prescription(°)	SD	Mean imprecision(°)	SD	Median	IQR	Significance.
Upper arch									
VL tip	Incisors	57	9.2	6.7	4.5	4.0	3.4	− 0.6	NS
	Canines	29	5.1	3.2	2.5	1.5	2.3	0.8	NS
	Premolars	53	5.1	3.4	3.1	2.6	2.1	− 0.5	NS
	Molars	37	3.9	1.4	2.9	2.2	2.5	0.3	NS
MD tip	Incisors	57	6.4	4.5	3.2	2.6	2.5	− 0.1	NS
	Canines	29	4.7	2.8	2.8	2.2	2.6	0.4	NS
	Premolars	53	4.6	3.3	3.6	2.3	3.9	1.6	NS
	Molars	37	4.5	1.6	3.4	2.3	3.4	1.1	NS
Rot.	Incisors	57	10.8	9.3	5.0	5.3	3.7	− 1.6	NS
	Canines	29	6.5	4.6	4.3	2.8	3.6	0.8	NS
	Premolars	53	7.0	6.7	3.5	3.1	2.9	− 0.2	NS
	Molars	37	7.2	4.8	4.8	4.6	4.4	− 0.2	NS
Lower arch									
VL tip	Incisors	64	5.9	2.1	2.9	2.6	2.3	− 0.3	NS
	Canines	30	7.2	5.0	3.5	2.8	3.1	0.3	NS
	Premolars	52	6.2	4.1	3.2	2.2	2.9	0.7	NS
	Molars	23	3.9	1.7	1.3	.9	1.9	1.0	NS
MD tip	Incisors	64	4.2	1.5	2.7	1.9	2.2	0.3	NS
	Canines	30	4.8	2.0	3.3	2.2	2.9	0.6	NS
	Premolars	52	5.4	4.7	3.4	2.6	3.1	0.5	NS
	Molars	23	6.3	3.7	4.3	3.0	3.5	0.5	NS
Rot.	Incisors	64	7.2	4.4	3.4	2.5	2.8	0.3	*
	Canines	30	12.4	10.0	6.9	5.4	5.5	0.1	*
	Premolars	52	7.3	6.0	5.4	5.8	3.7	− 2.1	NS
	Molars	23	4.6	2.8	2.0	1.8	1.4	− 0.4	*

VL tip vestibulolingual tip, *MD tip* mesiodistal tip, *Rot.* rotation, *SD* standard deviation, *IQR* interquartile range, *NS* not significant
*$p < 0.05$

movements differ from the ideal movements planned using digital setups is difficult to quantify experimentally. First and foremost, it is necessary to identify stable structures within the oral cavity that can be used as reference points for superimposition of digital images. Among these, the palatine folds are the most frequently chosen [17], even though several studies have shown that their position and/or dimensions may vary in certain clinical conditions [18]. Furthermore, palatal structures may only be used as reference points in the upper jaw. This is one of the reasons why superimposition on stable teeth has been selected as the method of choice for evaluating the accuracy of Invisalign by several authors [14, 19, 20]. However, that method may only be used in cases in which orthodontic treatment involves the displacement of only some teeth; moreover, even if this is the case, collateral effects on the position of other teeth cannot be ruled out. Indeed, intrusion may occur due to the masticatory forces exerted when wearing aligners, and any teeth used as anchorage may be subject to reactionary displacement [20].

The method of tooth position measurement proposed by Huanca [16], on the other hand, is based on the occlusal plane as a point of reference. Calculated as the plane passing through the mesiovestibular cusps of the first molars and the centroid of the FACC of all of the other teeth, with the exception of canines, the occlusal plane is a reference that enables the measurement error due to tooth movement during orthodontic treatment to be minimised. Moreover, it is applicable to both arches in all individuals, and allows evaluation of orthodontic movement of all teeth, both anterior and posterior. What is more, the reliability of this method has been demonstrated for tooth movements greater than 2°, at which it displays no measurement or systematic error.

Using this method, we demonstrate that the mean accuracy of orthodontic movement provided by the F22 aligner is