Table 4 Accuracy of movements achieved

	N	Mean accuracy	Standard deviation	Mean standard error	Significance
Upper arch					
VL tip incisors	28	0.65	0.34	0.064714	*
VL tip canines	16	0.54	0.57	0.143044	*
VL tip premolars	32	0.70	0.81	0.142849	*
VL tip molars	16	0.52	0.53	0.133131	*
MD tip incisors	36	0.77	0.58	0.096078	*
MD tip canines	16	0.78	0.50	0.125380	NS
MD tip premolars	27	0.71	0.78	0.150417	NS
MD tip molars	22	0.98	0.98	0.217782	NS
Rot. incisors	45	0.61	0.29	0.042538	*
Rot. canines	25	0.62	0.66	0.131114	*
Rot. premolars	29	0.54	0.54	0.100854	*
Rot. molars	18	0.78	0.61	0.144458	NS
Lower arch					
VL tip incisors	35	0.86	0.65	0.109173	NS
VL tip canines	15	0.66	0.55	0.142351	*
VL tip premolars	29	0.90	0.82	0.151409	NS
VL tip molars	7	0.86	0.51	0.191882	NS
MD tip incisors	31	0.88	0.86	0.154196	NS
MD tip canines	18	0.87	0.82	0.193936	NS
MD tip premolars	33	0.97	0.97	0.168750	NS
MD tip molars	17	0.62	0.82	0.199778	NS
Rot. incisors	51	0.67	0.57	0.080357	*
Rot. canines	25	0.54	0.74	0.147841	*
Rot. premolars	36	0.83	1.38	0.229989	NS
Rot. molars	14	0.85	0.67	0.180257	NS

VL tip vestibulolingual tip, *MD tip* mesiodistal tip, *Rot.* rotation, *NS* not significant
*$p < 0.05$

73.6%, considering all movements in both anterior and posterior teeth, while it falls to 70.6% if only the anterior teeth are considered. Although derived from a different methodology, these figures appear to compare favourably with the 56 and 41% predictability achieved by Invisalign for anterior teeth reported by Nguyen and Cheng [21], and Kravitz et al. [14], respectively.

We found that the most accurate movement achieved by F22 was mesiodistal tipping, whose mean accuracy was 82.5% (SD = 77.4) overall, and 96.7% at the lower premolars (SD = 96.9), closely followed by the upper molars (93.4%, SD = 72.6) and lower incisors (87.7%, SD = 85.9%). Less precise movements were found to be vestibulolingual tipping of the upper molars (52.5%, SD = 53.3) and upper canines (54.0%, SD = 57.2%) and rotation of the upper premolars (54.0%, SD = 54.3) and lower canines (54.2%, SD = 73.9) (Table 6, Fig. 6).

Rotation

Rotation movements, especially of rounded teeth like the canines and premolars, are notoriously difficult to achieve with aligners. Indeed, one prospective study [19] conducted on 53 canines in 31 subjects found a mean canine rotation accuracy of 36%. Greater canine rotation accuracy can be achieved with interproximal reduction (IPR), but this only provides an accuracy of 43%, albeit with a lower standard deviation (SD = 22.6%). Another study [14] found a rotation accuracy of 32% at the upper canines and even less at the lower canines (29%), as compared to the upper central (55%) and lower lateral incisors (52%). Moreover, there is an even further significant reduction in the accuracy of upper canine rotation at rotations of greater than 15° (19%; SD = 14.1%; $P < .05$).

Our data confirm that among the lower teeth canine movement is the least accurate. That being said, our