

Clear aligners brands and marketing claims: An overview of available information on the web

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Objectives: To investigate the current commercially available clear aligners related to brands, companies, Google trends, and marketing claims presented on their official websites.

Materials and methods: A search was conducted in October 2020 to identify the relevant web-based information, using three languages (English, Chinese, and Korean) and search terms “clear aligner”, “隱形牙套”, “隱形牙套”, and “투명교정장치” in four search engines (Google, Bing, Baidu, and Naver) to identify current clear aligner companies. Each company website was reviewed and assessed for its marketing claims.

Results: A total of 75 clear aligner brands were identified and included in the study, and 280 claims from their official websites were analysed. Most (70.7%) of the companies made claims regarding “aesthetics”, 66.7% made claims regarding “increased comfort”, 58.7% made claims regarding “shorter treatment time”, and 56.0% of the companies made claims regarding “superior material”. Other claims were made regarding their “novel technology”, “superior hygiene”, “tracking Apps”, “remote monitoring”, and “reduced in-office visits”. Of these marketing claims, only 4.5% cited references supporting the company’s website claims; however, the references were mainly derived from internal company research.

Conclusions: Using three languages (English, Chinese, and Korean), 75 different brands of clear aligners were currently found online. Most of the marketing claims from the clear aligner companies’ official websites were not referenced to quality scientific studies. Clinicians and patients should critically appraise the content of company claims and advertisements.

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Introduction

Clear aligners (CA) are vacuum-formed clear thermo-plastic appliances that fit tightly over the teeth. The name, aligner, was coined as the appliance was typically used to correct and align mildly displaced teeth, for example, irregular incisors in the maxillary or mandibular arch after orthodontic retainers had been discontinued. The concept of clear aligner therapy (CAT) may be traced back to Kesling in 1945.¹ Initially used as a tooth positioning appliance, it was discovered that aligners produced tooth movement after vacuum-forming manufacture over repositioned teeth.²

CAT has gained immense recent popularity, particularly after the introduction of the Invisalign system into the orthodontic market by Align Technology, Inc. in 1998.^{3,4} CAT appliances are fabricated through a computerised process, over a sequence of casts following incremental dental changes, so that more extensive tooth movements are achieved. Over time, numerous types and brands of CA have been developed and globally marketed. The increase in popularity for CAT has, in part, been fuelled by the rise in awareness and demand for dental aesthetics, leading adults to seek an appealing alternative to fixed

appliance therapy.³ In addition, direct-to-consumer (DTC) advertising has increased patient awareness and further driven the demand for aesthetic and ‘efficient’ orthodontic treatment.

CAT has several advantages over traditional fixed appliances, related to aesthetics,⁵ oral hygiene,⁶ less self-reported initial pain, and a reduced number of emergency appointments.⁷ Moreover, the development of digital technology allows the clinician to determine the treatment sequence, movement of individual teeth, and the speed of movement for each stage of treatment. It also enables visualisation of a diagnostic set-up before planned extractions thus enhancing patient communication.⁷ However not all CA brands are equal and offer the same standard of technology. Weir illustrated several differences between the available marketed brands, noting fundamental differences between materials, fabrication, the variety of attachments to improve biomechanics and critically, the input of the clinician.³ It was concluded that the variation between appliances was profound and clinicians needed to be aware of the differences. The number of CA brands entering the market has been increasing and more brands are embracing direct-to-patient advertising with some offering orthodontic services that bypass any form of clinical examination. These brands are often advertised as cheaper, faster, and more aesthetic than traditional orthodontics.

Given the inconsistent information, the present study aimed to investigate the existing and available CA brands and companies and assess their marketing claims.

Materials and methods

The search strategy was initially conducted through Google and adapted for the other search engines (Bing, Baidu, and Naver). The search was carried out using the term “clear aligner” (which covered the related terms such as “clear aligners”, “clear aligner company”, “clear aligner companies”, “clear aligner brand”, and “clear aligner brands”, according to the Google algorithm and truncation); “隐形牙套” (the simplified Chinese character), “隱形牙套” (the traditional Chinese character), and “투명교정장치” (clear aligner in Korean language) were searched on Baidu (the leading search engine in China) and Naver (the main search engine used in South Korea), respectively. All searches (using the English, Chinese

and Korean languages on Google, Bing, Baidu, and Naver) were carried out in October 2020. All websites related to the brands of clear aligners were included for assessment while other non-relevant websites such as dental laboratories and software companies, were excluded.

Based on the algorithm of Google Trends,⁸ the “clear aligners (topic)”, which is equivalent to the MeSH (Medical Subject Headings) term in the PubMed database, was used to explore the search trends and the frequency that the clear aligner(s) was entered into Google’s search engine, including the interest over time, interest by region, related queries, and topics.

The official website of each CA company was reviewed in October 2020. Details regarding the country of origin, year of establishment, and marketing claims were collected. All marketing claims were quoted, recorded, and subsequently categorised into different schemes, such as “material”, “comfort”, “cost”, “aesthetics”, “length of treatment”, and “others”.

Results

Brands and companies

A total of 97 CA brands were identified using the search engines. Seventy-five brands were included in the study (Table I). Twenty-two results were excluded because 3D scanner or software companies (e.g. 3 Shape and Orchestrate3d), dental materials (e.g. Zendura), dental labs or private practices, were identified.

The first commercial clear aligner company, Invisalign (Align Technology, San Jose, California, USA), was established in 1998 (Figure 1, Figure 2 and Table I). Subsequently, the number of companies entering the market has increased and, during 2018 and 2019, the highest number of new CA companies were introduced (6 companies each year).

The countries of origin for the 75 brands included in the present study are mapped (Figure 3 and Table I). Approximately half of the brands ($N = 39$, 52.0%) originated from the USA ($N = 28$, 37.3%) and China ($N = 11$, 14.7%). Geographically, the origin of the brands was distributed between North America, Asia, Europe and Australasia (Figure 3). Most large companies have globalised their products and expanded internationally. For example, the biggest clear aligner brand in the market currently, Invisalign, is available in over 100 countries and regions.

Table 1. Summary of all aligner brands.

	Brand	Company	Country	Year Established	Official website	Clinicians	Patients
1	32 Watts Clear Aligners		India	2018	https://www.32watts.com/	Y	Y
2	360美牙隱形矯正		China	2019	http://www.360meiya.cn/	Y	Y
3	ACE Aligners		U.S.	N/A	acealigners.com	Y	Y
4	AIRNIVOL		Italy	2004	https://www.airnivol.com/en	Y	Y
5	Aligner Studio		U.S.	N/A	https://www.alignerstudio.com/	Y	Y
6	AlignerCo		U.S.	2019	https://www.alignerco.com/	Y	Y
7	Angelalign 时代天使隱形矯正	Angelalign	China	2003	http://www.angelalign.com/	Y	Y
8	Argen		U.S.	2018	https://argen.com/clear-aligners/#/	Y	Y
9	byte		U.S.	2018	https://www.byte.com/	Y	Y
10	CA Clear Aligner	Scheu-Dental	German	N/A	http://ca-clear-aligner.com/en/b2c/index.html	Y	Y
11	Candid CO		U.S.	2017	https://www.candidco.com/	Y	Y
12	Clarity Aligners	3M	U.S.	2018	https://www.3m.com/3M/en_US/typesofbracesandtreatmentus/clear-aligners/	Y	Y
13	Clarus Clear Aligners		Egypt	N/A	http://www.clarusaligners.com/	Y	Y
14	Clear correct	Straumann	Switzerland	2006	https://www.straumann.com/clearcorrect/en/home.html	Y	Y
15	Insignia Clearguide System	Ormco	U.S.	2012	https://ormco.com/products/insignia-clearguide/	Y	Y
16	Clearline Aligners		Canada	N/A	https://www.clearlinesmile.ca/	Y	Y
17	Clearlyaligners		U.S.	N/A	https://clearlyaligners.com/	Y	Y
18	ClearPath		U.S.	2008	https://www.clearpathdental.com/	Y	Y
10	ClearPath Orthodontics		Pakistan	2007	https://www.clearpathortho.com/	Y	Y
20	ClearSmile	IAS Orthodontics	UK	N/A	https://www.clearsmilealigner.com/	Y	Y
21	ClearX	K Line Europe	German	N/A	https://www.clearxaligners.com/	Y	Y
22	Coast Clear Aligners	Coast Dental & Orthodontics	U.S.	N/A	https://www.coastdental.com/aligners	Y	Y
23	ddhaim clear 디디하임 클리어		Korea	N/A	http://ddhaim.com/	Y	Y
24	Dr. Clear aligner		Singapore	N/A	https://www.drclearaligners.com/	Y	Y
25	Easysmile	Easysmile	China	N/A	https://www.easysmile.com/	Y	Y
26	ealigner 이클라이어너	Ealigner international	Korea	1998	http://www.ealigner.com/	Y	Y

27	eon Aligners	U.S.	N/A	https://eonaligner.com/index.html	Y
28	EZ Smile Clear Aligners	Australia	N/A	https://www.ezsmile.com.au/	Y
29	f22 Aligners	Italy	2012	https://www.f22aligner.com/	Y
30	FrankSmile	UK	N/A	https://www.franksmile.co.uk/	Y
31	Hibeauty 隐秀隐形矫正	China	2012	http://www.hibeauty.com/pt/index.htm	Y
32	Inman Aligner	U.S.	2001	https://www.inmanaligner.com/	Y
33	Invisalign	U.S.	1998	https://www.invisalign.com/	Y
34	iROK	China	2009	https://5ismile.com/	Y
35	JoyAligner	Singapore	N/A	http://joyaligner.com/	Y
36	K Clear	K Line Europe GmbH German	N/A	https://kline-europe.com/en/home	Y
37	magicalign 正丽科技隐形矫正	China	2014	http://www.magicalign.com/pc/index.html	Y
38	MegaNeer 美加易齐隐形矫正	China	2010	http://www.mega-teeth.com/Products/yzj/	Y
39	Noviclear		N/A	http://noviclear.com/	Y
40	Nuvola	GEO Orthodontic UK	N/A	http://www.georthodontic.com/	Y
41	ODS Aligners	India	N/A	https://odsaligners.com/	Y
42	Orthocaps TwinAligner System	Ortho Caps GmbH Germany	2006	https://www.orthocaps.com/	Y
43	OrthoClear	UK	2005	https://www.orthoclear.nl/en/	Y
44	OrthoFX	U.S.	2019	https://www.orthofx.com/	Y
45	OrthoSnap	U.S.	N/A	https://www.orthosnap.com/	Y
46	Pure Smiles Online	Canada	N/A	https://www.puresmilesonline.com/	Y
47	Refine Complete Aligner System	TP Orthodontics U.S.	2017	https://www.tportho.com/wp-content/uploads/2017/04/996-385ENG+Refine-B2B_2017_OW.pdf	Y
48	reveal Clear Aligners	Henry Schein U.S.	2019	https://www.henryschein.com/us-en/dental/supplies/reveal.aspx	Y
49	RxAligners	UK	2011	http://rxaligners.com/	Y
50	See-Through Aligner 시스템 열라이너	시스템테크 Korea	2014	http://www.saligner.com/	Y
51	simpli 5	Ormco U.S.	2006	https://ormco.com/products/simpli-5/	Y
52	Sino Dental Lab	Sino Dental Lab China	N/A	http://www.sino-dental.com/cn/product-details-69.html	Y
53	SIX Clear Aligners	Henry Schein U.S.	2018	https://sixclearaligners.com/	Y

54	Smartee 正雅隐形矫正	Smartee	China	2004	http://www.smartee.cn/	Y
55	Smile Direct Club		U.S.	2014	https://smiledirectclub.co.nz/en-nz/	Y
56	Smile Love		U.S.	N/A	https://smilelove.com/	Y
57	Smile Styler		Australia	N/A	https://www.smilestyler.com.au/	Y
58	Smilealign 适乐美	Smilealign	China	N/A	https://www.smilalign.cn/	Y
59	Smilelign		UK	2012	https://smilelign.com/	Y
60	SmileTRU		U.S.	N/A	https://www.smiletru.com/	Y
61	smilii		NZ	2019	https://www.smilii.co.nz/	Y
62	SnapCorrect		U.S.	2012	https://snapcorrect.com/	Y
63	Spark Clear Aligner System	Ormco	U.S.	2019	https://mysparksmile.com/	Y
64	Straight My Teeth		UK/Ireland	2018	https://www.straightmyteeth.com/	Y
65	Straight Teeth Direct		UK	2009	https://www.straightteethdirect.com/	Y
66	Straight28 Clear Aligners		U.S.	N/A	http://straight-28.com/	Y
67	Strayt Clear aligners		U.S.	N/A	https://www.straytteeth.com/	Y
68	SureSmile	Dentsply Sirona	U.S.	1999	https://www.suresmile.com/	Y
69	Trioclear		Hong Kong	2020	https://www.trioclear.com/	Y
70	Uniform Teeth		U.S.	2016	https://www.uniformteeth.com/	Y
71	V-Clear Aligners		India	N/A	http://www.vclearaligners.com/	Y
72	Vincialign 达芬奇隐形矫正	Vincialign	China	N/A	https://cn.vincialign.com/index/index	Y
73	Whitesmile Clear		Malaysia	N/A	https://whitesmileclear.com/	Y
74	Wonder Smile		Australia	2016	http://wondersmile.co.nz	Y
75	Zenyum		Singapore	N/A	https://www.zenyum.com/sg/en/	Y

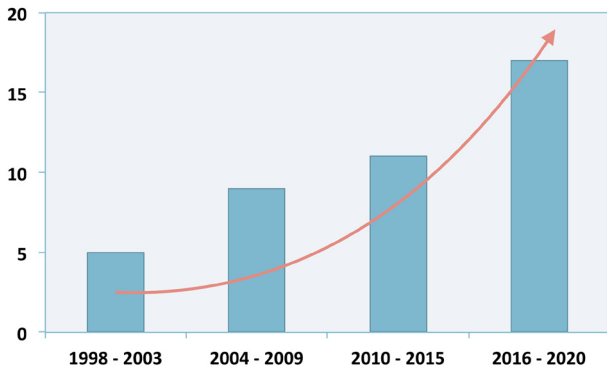


Figure 1. Number of companies entering the market relative to year.

Google trends

Google trend results showed an increasing trend for web searches on Google (Figure 4). It was noted that there was a significant reduction during April 2020 at the outbreak of the Covid-19 pandemic. The top five

regions were the United States, Singapore, Ireland, Canada, and Australia. The related topics and queries were associated with braces, cost, Invisalign, and tooth.

Business model

Most of the clear aligner companies ($N = 59$, 78.7%) required patients to visit a qualified clinician for a consultation and initiation of treatment and about 21.3% of the companies ($N = 16$) were directly available to patients without an initial dental visit (Table I).

Marketing claims

Marketing claims were gathered from the official websites of the companies included in the present study and based on the claims, six main themes were identified (Table II). Most companies ($N = 53$, 70.7%) made claims regarding “improved aesthetics”, 50 (66.7%) companies made claims regarding “increased comfort”, 44 (58.7%) companies made claims regarding “improved length of treatment”, 42 (56.0%) companies made claims regarding “superior materials”, and 37 (49.3%) companies made claims regarding “treatment cost”. Additional claims were made regarding “novel technology”, “superior hygiene”, “tracking Apps”, “remote monitoring”, and “reduced in-office visits” (Figure 5).

Only 4.5% the marketing claims ($N = 7$) cited references on their official websites to support the marketing claims; however, the available supporting evidence was predominantly internal studies and experiments conducted within the company rather than sourced from the peer-reviewed scientific journals.

About half ($N = 36$, 48.0%) of the companies disclosed a price on their official website. The prices ranged from US\$1,145 to US\$2,950, depending on the length of treatment, type of product, and the difficulty of the case. Seven companies (9.3%) were publicly traded in October 2020.

Discussion

The increase in public awareness of dental aesthetics has led to an increase in the demand for more aesthetic orthodontic treatment methods. This directly corresponds to the observed increase in the number

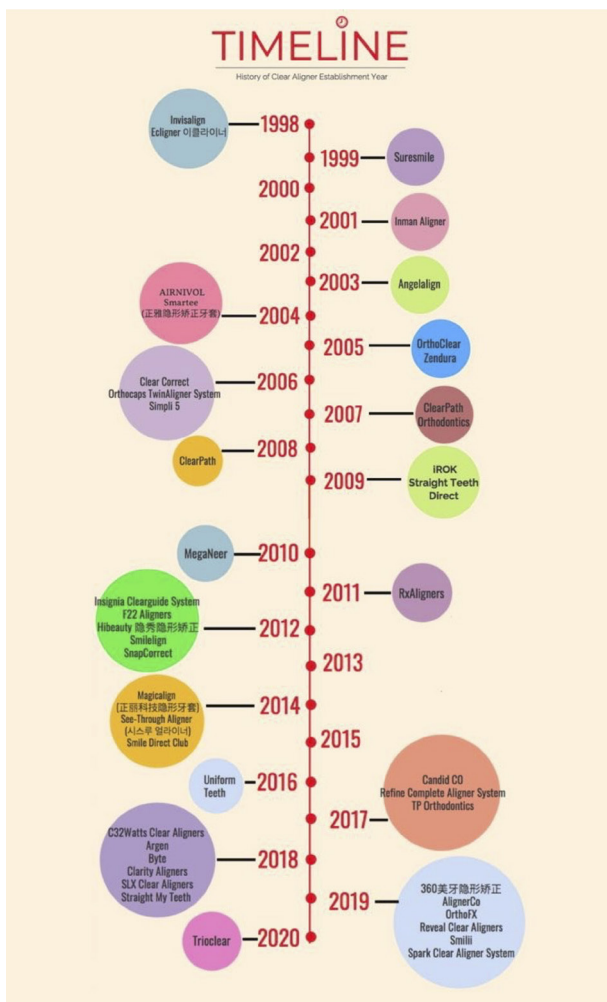


Figure 2. Timeline of Clear Aligner brand establishment years.

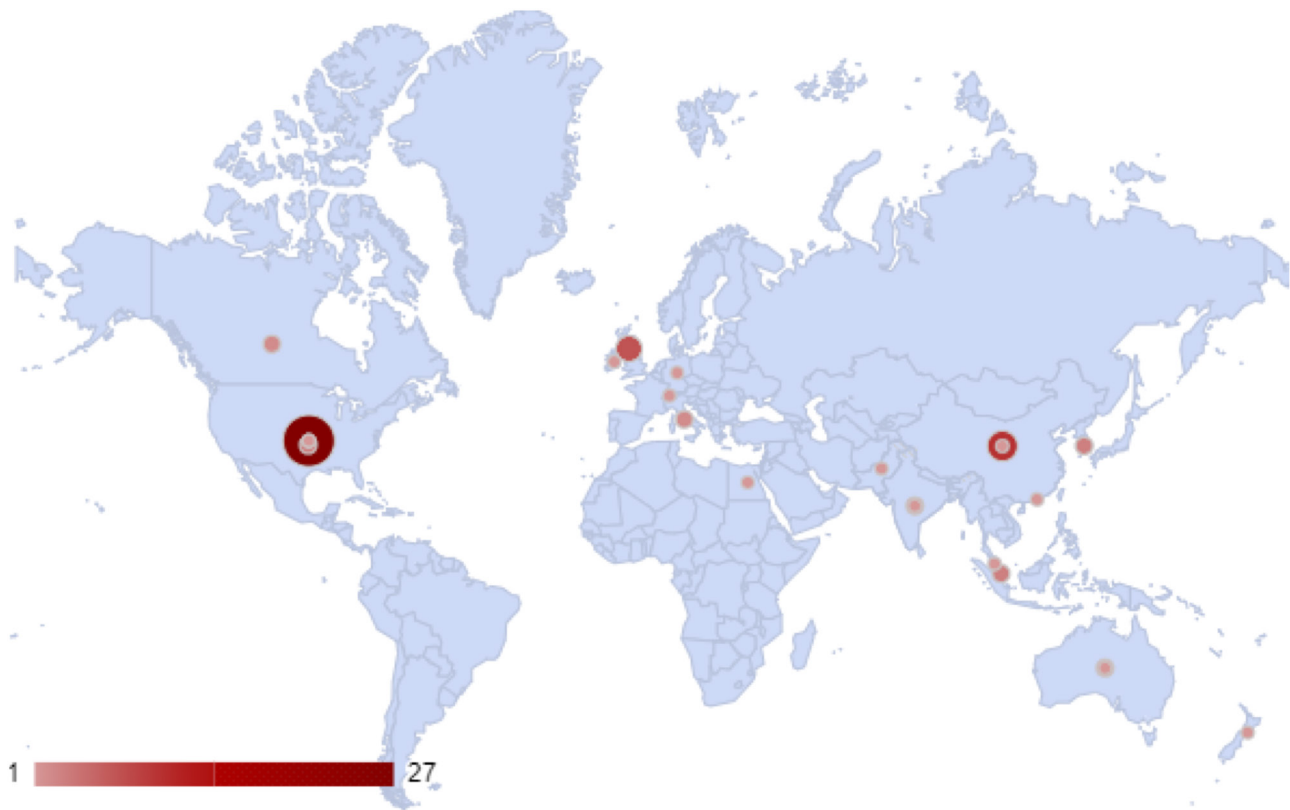


Figure 3. Distribution of clear aligner companies geographically.

of dental practitioners providing CAT.⁹ Various marketed, numerous CA orthodontic products now exist worldwide.¹⁰ With a wide range of market options available and the convenience of online accessibility, dental practitioners need to assess and determine the reliability of product claims.

Previous studies have investigated whether claims made in orthodontic journal advertisements are evidence-based.¹¹ However to date, no published articles have evaluated the marketing claims made on the official websites of clear aligner companies. Traditionally, an emphasis was placed on the specialist's appeal to general dentists for referrals in the orthodontic marketing model. But the introduction of CAT has created a shift towards DTC advertising,^{9,12} which is evident through remote treatment options and reduced in-office visits.

The marketing claims on the official websites of the clear aligner companies included in the present study seemed promising; however, the majority (95.5%) lacked evidence-based research to substantiate marketing claims.^{12,13} References from quality scientific

studies were limited on the official websites of clear aligner companies. Claims made on the homepage of a popular company (i.e. Invisalign) had supporting references; however, rather than being readily accessible, the research evidence is kept as data-on-file under the company name. Additional company marketing claims were certified by a comparison of their products against those of another company, which was named as "others". An experiment of placing the aligners in coffee for 8 hours and providing photos to compare the aligners with the level of staining was used as evidence of superior stain resistance. Further evidence was similarly provided by side-by-side photographic comparison of their superior clarity and lack of attachments. More supporting experimentation or scientific proof of better function are still needed. Another company advertised advantages, such as the use of a novel material and a biomechanics analysis system. According to this company, the aligner material is 0.75 mm in thickness and produces a more stable and constant force thereby improving comfort for patients. Two graphs were presented on the official website,

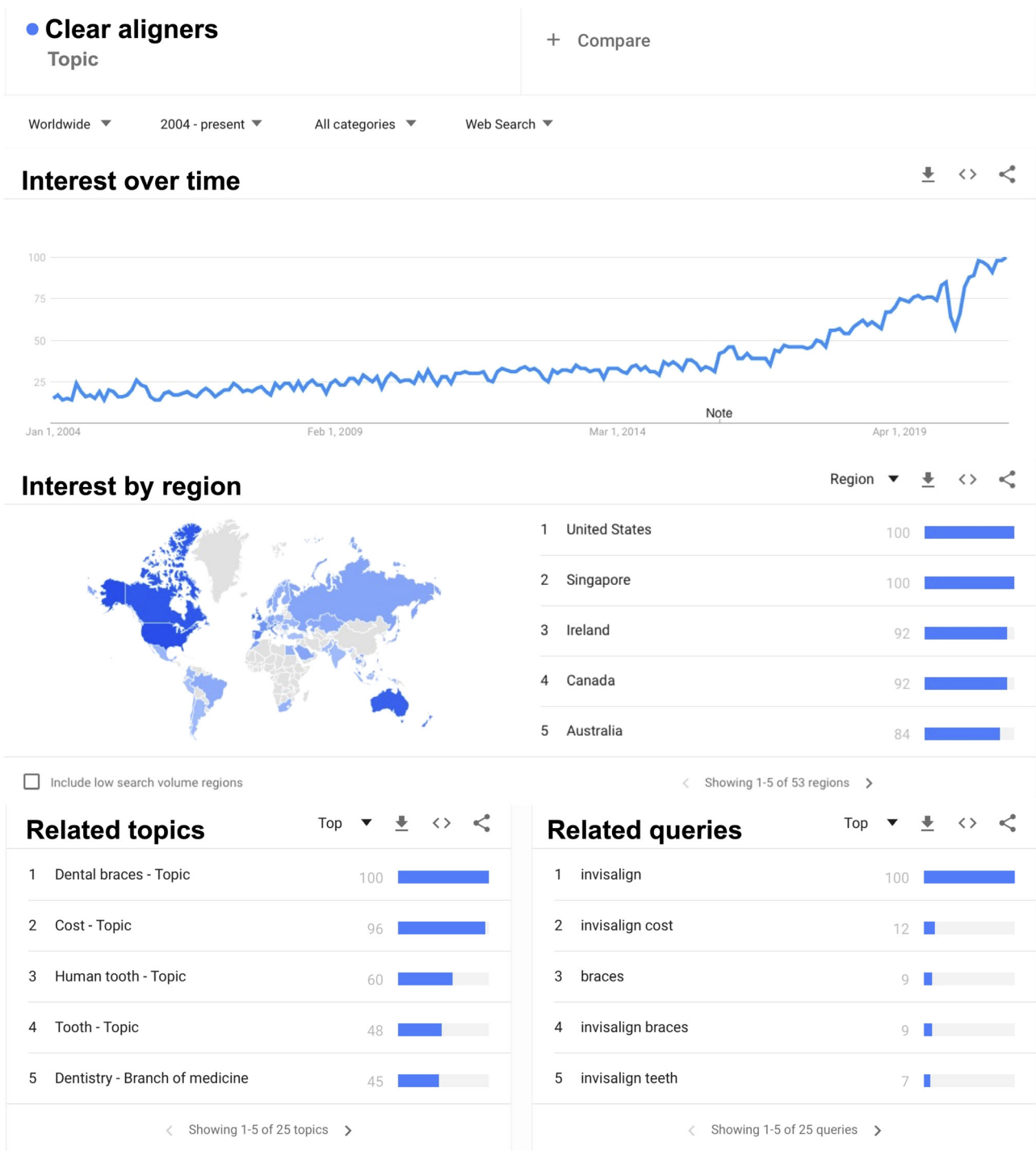


Figure 4. Google Trends of the search of clear aligners. (The earliest data available on Google Trends is from 2004).

supporting the marketing claim of “increased efficiency in tooth movement” and “stable, constant orthodontic force”. The graphs compared their product with an unnamed ordinary clear aligner, showing extended tooth movement within the same period of time. The product was also claimed

to have a lower mechanical starting force with less attenuation compared to a rival product; however, the graph results were not scientifically referenced, and the attenuation performance graph did not have a force value stated on the vertical axis. Another aligner company has marketed its product by highlighting

Table II. Marketing claims found the official websites of the clear aligners companies included in the study.

Marketing claim theme	Number of companies	Number of claims with evidence cited
Improved material	42	4*
Better comfort	50	1
Shorter treatment time	44	Not Applicable
Enhanced aesthetics	53	2
Lower cost	37	Not Applicable
Others	54	2

*Seven companies claimed of using Raintree Essix plastic but evidence was not provided on their websites, therefore is not included in the evidence-based claims count.

multiple advantages, notably “minimal attachments” which makes their aligners aesthetically superior to other clear aligner brands and “unnoticeable” to others. In addition, it is claimed that an increase in gingival coverage improves the predictability of tooth movements. The claims were allegedly supported by “multiple scientific studies”, such as “studies showing coverage of the gingival edge increases orthodontic forces to an acceptable amount.” Reference to the scientific studies was not available on the official website.

To supplement the increased public demand for aesthetic treatment, orthodontic manufacturers have developed aesthetic appliances with reduced visibility,^{6,14} resulting in aesthetics becoming an influential marketing claim. The findings of the present study show that “aesthetics” appeared to have the most advertised claims. Words such as “invisible”, “transparent”, and “clear” have been frequently used by the majority of the identified companies. A curious observation is that, while most companies claimed that clear and transparent aligners have better aesthetics, some claimed “not too shiny” have better aesthetics, while others claimed that reduced light transmittance and surface reflection improved invisibility. Another company claimed that the material being matte, rather than clear, can diffuse light reflection which increases invisibility. This highlights the differential perception of superior aesthetics by different manufacturers, which in turn, may be related to the variable standards of beauty across the globe.

Comfort is a marketing claim that is frequently mentioned by company advertising. Terms such as “comfortable”, “smooth”, “non-irritating” and “hygiene” had high recurring frequencies in the marketing claims. These align with the advantages of clear



Figure 5. Word Cloud for recurring marketing claims. With the terms most frequently mentioned in the claims largest in size and less frequently mentioned smaller in size on the figure.

removable aligners compared to fixed orthodontic treatments in general. It is a strong marketing starting point, as it raises customer awareness of the benefits of clear aligners over fixed appliances. This might explain the high frequency of these terms in the company marketing claims as fixed orthodontic treatments are the traditional way of straightening teeth and well known by the public. To emphasise the advantages of clear aligners over braces is an effective way to enter the market.

The manufacturing material is an influential biomechanical factor of clear aligners, which encompasses the properties, thickness and the accuracy of fit.³ In the present study, 7 (16.7%) of 42 brands that made specific claims regarding the manufacturing materials used Raintree Essix plastic (Dentsply Sirona). Another company accentuated the outperformance of its material in comparison to other existing clear aligner materials such as Essix, Biocryl, and DuraClear. A series of bar and line graphs are publicly visible on its main website and have been claimed to be “scientific research made for various brands of transparent braces”. The graphs reveal that the proprietary product to be “significantly more crack resistant”, “significantly more odour and stain resistant” and “stronger for longer”. However limited references were provided on their websites to support the graphs shown. A European company claimed to have 15 years of research conducted by their academic team and to have authoritative scientific university support; however, references were not available on their website.

It was difficult to accurately report on the timeline of brands entering the market as some companies did not display the information on their webpage. Based on the available data, the number of clear aligner companies entering the dental market continues to show an upward trend. A previous study has reported 27 different aligner brands available and accompanied by various different business models.³ The present study showed a substantial increase to 75 brands over five years with 2018 and 2019 showing the largest increase. Including the Chinese and Korean languages as well as English may also be responsible for identifying more brands than in previously reported literature.

Almost a quarter of the identified brands (24%) offered clear aligners as a DTC model. In this model, patients are not required to consult a dentist nor orthodontist as part of their treatment. Instead, dental impressions are taken at home or intraoral scans are taken at the

company’s facilities. The treatment plan is digitally developed, and the aligners are mailed directly to the patient who monitors their own treatment. It remains a controversial area of concern if each patient’s treatment plan is not reviewed by a dental professional. For example, some claims are made on DTC websites to offer “remote monitoring by an orthodontist” and no chairside professional consultation is required. These marketing claims are mainly aimed at the public (either via a clinician or not). The actual reason for the difference in the marketing claims between different companies is still unclear and may be related to the companies’ marketing strategies, or related to the different language/cultural backgrounds.

There were several limitations related to this research. Only three languages (English, Chinese and Korean) were interpretable by the researchers. The companies that did not target the population who speak these languages or did not have official websites translated into these languages were unable to be located and included in the research. The main search engines in English, Chinese, and Korean were utilised, and companies that did not have a readily accessible official website for product information were unable to be identified by these search engines. An expansion of the language inclusion and the use of additional search engines could lead to the discovery of more clear aligner brands. All searches were performed in October 2020, and an increase in the length of the research period may alter the data and lead to a different outcome as the companies’ websites are subject to updates and changes.

No attempt was made to contact manufacturers to obtain full records of data-on-file references. However, previous studies conducted on pharmaceutical companies have found low success rates in obtaining requested reference files.¹² Therefore, contacting the companies in this case may likely have had limited impact on the results.

Conclusions

Clear aligners have continued to rise in popularity, with an increasing number of companies and brands entering the market. Companies displayed extensive marketing claims in an attempt to differentiate themselves from other brands; however, most did not provide supporting evidence on their official websites. The lack of evidence supporting marketing claims may lead to general public misconception, thereby affecting the ability to make informed decisions related to the

choice of desired clear aligner brand. Clinicians should be equipped with the basic knowledge regarding clear aligners and critically appraise the content of claims and company advertisements.

Conflict of Interest

The authors declare that there is no conflict of interest.

Availability of data and material

All data generated or analysed during this study are included in this published article.

Authors' contributions

CS, YF and YH performed the study, collected the data, and drafted the manuscript. JM and CJ contributed to the design of the study and revising the manuscript. LM and MF contributed to the conception and design of the study, writing and revising the manuscript. All authors read and approved the final manuscript.

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