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BRIEF COMMUNICATIONS

# Internet searches for Invisalign® orthodontic aligner: an infodemiological study using google trends tool

# Buscas na internet sobre alinhador ortodôntico Invisalign®: um estudo infodemiológico usando ferramenta google trends

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## Abstract

**Aim**: to evaluate the internet searches for Invisalign® in Brazil and worldwide between 2018 and 2021, using the Google Trends tool. **Methods:** An infodemiological study was carried out. The relative search volume (RSV) for the term "invisalign" in Google platform was retrieved for each year of study, both in Brazil and worldwide, using a standard procedure. **Results and Conclusion**: Both in Brazil and worldwide, there was a statistically significant increase in RSV between 2018 and 2021 (all $p < 0.05$), indicating progressively more interest in Invisalign® clear aligner on the internet.

**Keywords:** Invisalign; Orthodontics; Epidemiology; Internet.

## Resumo

**Objetivo:** avaliar as buscas na internet por Invisalign® no Brasil e no mundo entre 2018 e 2021, utilizando a ferramenta Google Trends. **Métodos**: Foi realizado um estudo infodemiológico. O volume relativo de busca (RSV) para o termo "invisalign" na plataforma Google foi recuperado para cada ano de estudo, tanto no Brasil quanto no mundo, utilizando um procedimento padrão. **Resultados e Conclusão**: Tanto no Brasil quanto no mundo, houve um aumento estatisticamente significativo do RSV entre 2018 e 2021 (todos $p < 0.05$), indicando progressivamente mais interesse pelo alinhador transparente Invisalign® na internet.

**Palavras-chave:** Invisalign; Ortodontia; Epidemiologia; Internet.

The use of orthodontic appliances, such as orthodontic aligners, is a frequent therapy in dentistry, aiming to correct malocclusions. Clear aligners are common in orthodontic practice, considering their aesthetic and functional performance. Since 1998, with the introduction of the Invisalign® system, the use of clear aligners has spread worldwide[1], although the performance of these systems to correct malocclusions is still under investigation[2,3]. However, there is evidence of patient satisfaction using Invisalign®, especially in eating and chewing, when compared to patients who used brackets[4].

In 2020, an investigation reported that Invisalign® was the most searched term for clear orthodontic aligners on the Google platform, and content about this term on the YouTube™ platform was often unsatisfactory[5]. Moreover, another investigation using data from the Google platform by the Google Trends tool identified that there was a significant impact on searches for terms related to orthodontics during the COVID-19 pandemic. However, the time span was short, effectively comparing 2019 and 2020[6].

In fact, internet searches have become increasingly frequent to reach health content5,6. A Brazilian investigation reported an increase in web search trends for terms related to oral health, such as toothache, during the COVID-19 pandemic[7], but no information was found on digital interest in Invisalign® in this country. Then, this investigation evaluated the internet searches for Invisalign® in Brazil and worldwide between 2018 and 2021, using the Google Trends tool.

An infodemiological, exploratory and quantitative study was carried out, following the procedure described by Lima et al. (2021)[7]. To report, the checklist proposed by Nuti et al. (2014) for Google Trends approaches was used8. It was not necessary to obtain ethical approval. Data collection was carried out in February 2022, using the Google Trends tool (https://trends.google.com.br/trends).

The search strategy was a single term: "invisalign". This term was placed in four search boxes, corresponding to the years 2018, 2019, 2020 and 2021, switching each one properly in

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the option “custom period - full year”. In all boxes, the options “all query categories” and “web searches” were inserted. In the first stage, data about Brazil were collected, switching the option "place" to "Brazil". Then, after data collection, the option "local" was switched to "worldwide".

In each search, we retrieve the normalized relative search volume (RSV) across all years, expressed as a value from 0 to 100 (peak of interest)[7], as well as the graphic distribution generated by Google Trends tool. The peak of interest corresponds to the moment when a greater number of searches were performed and is used to normalize the other periods, allowing analytical approaches to the RSV. Then, the RSV of each year for the same term must be retrieved in the same search, so that it is normalized[7,8]. The RSV was imported into a spreadsheet with 52 units in each year (corresponding to 52 annual weeks, self-adjusted by the algorithm).

The jamovi software (1.6.16, Sydney, Australia, 2020) was used for statistical procedures. Non-parametric tests were used to compare the RSV between years, both in Brazil and worldwide. The Kruskal-Wallis test was used to verify statistically significant differences between the groups, while the Dwass-Steel-Critchlow-Fligner (DSCF) test was selected for pairwise comparisons, as a post hoc approach. The significance level was set at 5%. To summarize the RSV of each year, the median (central tendency) and the first (Q1) and third (Q3) quartile (dispersion) were provided, as well as minimum, maximum and sum.

Figure 1 graphically shows the RSV for the term "invisalign" and the box-plot of the RSV in Brazil and worldwide over the years. Table 1 shows the descriptive and statistical analysis of the RSV for each year in Brazil and worldwide. In Brazil, it was possible to observe that there was a significant statistical difference in RSV between the years after the Kruskal-Wallis test ($p < 0.001$). The DSCF pairwise comparison showed that there was significant statistical difference in RSV between all years, increasing progressively between 2018 and 2021 ($p = 0.001$ or less). Worldwide, the Kruskal-Wallis test also showed a significant statistical difference between the years ($p < 0.001$), as well as the DSCF pairwise comparison showed that there was a statistically significant difference between all the years, similar to the outcome in Brazil (all $p < 0.001$).

**Figure 1.** Relative search volume for the term "invisalign" in Brazil (A) and worldwide (B) over the years. Box-plot graphic distribution of relative search volume for the term "invisalign" in Brazil (C) and worldwide (D).

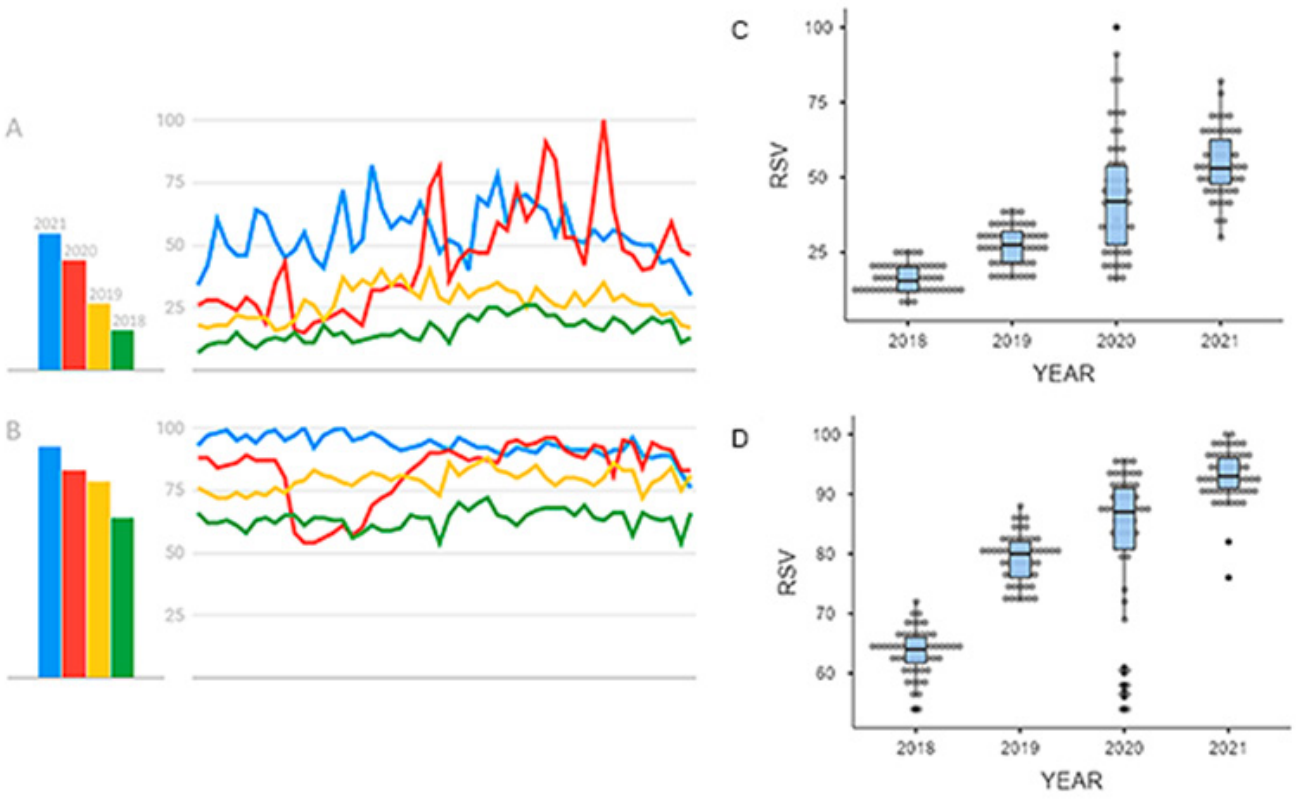

**Table 1**. Relative search volume of internet searches for Invisalign® orthodontic aligner in Brazil and worldwide.

| RSV | 2018 | 2019 | 2020 | 2021 | *p*-value |
|---|---|---|---|---|---|
| | | | **Brazil** | | |
| Median | 15.5 A | 27.5 B | 42.0 C | 53.0 D | <.001* |
| Quartile | Q1: 12.0 | Q1: 21.8 | Q1: 27.5 | Q1: 47.8 | |
| | Q3: 20.0 | Q3: 32.0 | Q3: 53.8 | Q3: 62.5 | |
| Minimum | 7 | 16 | 15 | 30 | |
| Maximum | 26 | 40 | 100 | 82 | |
| Sum | 845 | 1.419 | 2.271 | 2.841 | |
| | | | **Worldwide** | | |
| Median | 64.0 A | 80.0 B | 87.0 C | 93.0 D | <.001* |
| Quartile | Q1: 61.8 | Q1: 76.0 | Q1: 80.8 | Q1: 91.0 | |
| | Q3: 66.0 | Q3: 82.0 | Q3: 91.0 | Q3: 96.0 | |
| Minimum | 54 | 72 | 54 | 76 | |
| Maximum | 72 | 88 | 96 | 100 | |
| Sum | 3.303 | 4.116 | 4.308 | 4.841 | |

A/B/C/D: significant statistical differences; Q1: first quartile; Q3: third quartile. *: p-value <0.05.

Source: Google Trends tool (https://trends.google.com.br/trends).

It is important to note that in the worldwide RSV, the peak of interest (100) was observed in the year with the greatest interest from internet users, 2021. In Brazil, although 2021 was also the year with the greatest interest in Invisalign® orthodontic aligners, the peak of interest was observed a year earlier, in 2020.

The exponential increase in the RSV for the term "invisalign" in Brazil and worldwide is an interesting outcome for dentistry because, despite growing interest, there is evidence that internet content about clear aligners, including Invisalign®, is often unsatisfactory. This evidence demonstrates the need for enhanced internet content for this topic, allowing reflections on access to inappropriate content by internet users in Brazil and worldwide, considering that it is not possible to measure completely the impact of wrong information in the search for dental treatment, including orthodontic therapy[9,10].

It is noteworthy that the use of the internet to obtain information about oral health is frequent and has been investigated by the Google Trends tool[11]. However, it is necessary to recognize that the COVID-19 pandemic has affected the offer and access to oral health services due to social distancing measures. Then, it is possible to understand internet searches for oral health issues as a side effect. This point of view is important to understand the increase in RSV observed in pandemic years, such as 2020 and 20217,12. Hence, there is a need to continue monitoring the digital interest and the quality of the content available on the internet on this topic.

Between 2018 and 2021, both in Brazil and worldwide, there was a significant increase in internet searches for the term "invisalign", indicating the need to monitor the available content and internet users behavior. As a limitation, it is important to consider that it is not possible to evaluate the profile of users who searched for the term "invisalign" and composed the RSV retrieved in the Google Trends tool. Also, it is necessary to consider that only people with access to the internet and digital literacy were able to carry out this search, which restricts the observed outcome.

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