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Review

Transparent orthodontic archwires: A systematic literature review

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ABSTRACT

Objective: The objective was to perform a systematic literature review to report the state of the art on the topic of transparent orthodontic archwires.
Methods: The inclusion criteria: (1) transparent or translucent orthodontic wire, (2) production method presented, (3) physical properties tested. The exclusion criteria: (1) coated esthetic archwires, (2) repetitive publications without language limitations. Databases searched: Medline (via PubMed), Scopus, Embase and Ovid (from 1970.01.01 to 2016.02.01). Additional hand search was performed. The manual search was performed in selected orthodontic journals: American Journal of Orthodontic and Orthopedics, Angle Orthodontist, European Journal of Orthodontics (from 1995 to 2016.02.01).
Results: Among 342 papers, 22 were selected for systematic review and divided into two groups: those commercially available on the market and those in research and development stage. The drawbacks associated with mechanical properties limit their widespread clinical use.
Conclusions: The papers reported different materials presenting different characteristics by various methodology. For this reason it was difficult to objectively compare obtained results. Characterization of translucent archwires properties has shown that further studies are required to confirm the usefulness of this type of wires, also in clinical practice.

1. Introduction

Transparent fixed orthodontic appliances have the potential of creating a niche market. Patients expect not only effective treatment, but also an esthetic smile during orthodontic treatment. It is the interest of patients in orthodontic appliances made of transparent elements that generates the need to develop innovative materials.

Traditional orthodontic archwires are manufactured usually from stainless steel, cobalt-chromium-nickel alloy, nickel-titanium or titanium alloys [1]. Despite insufficient esthetic

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properties, some of the components of the alloys mentioned above exhibit allergic properties (like releasing Cr and Ni ions) [2]. Attempts at applying metal wires coated with a layer whose color was that of the natural tooth enamel were successful, although not free of drawbacks such as: coating can wear or peel, limited bending, the thickness of the layer being confined by the small diameter of the wire [3].

New technologies allow for the development of materials with innovative structures, constituting elements of orthodontic appliances. There has always been an expectation for the appliance to have an esthetic appearance both during and after treatment. Contemporary fixed appliances consist of a number of elements: brackets, bands, wires, ligatures. So far, only orthodontic brackets (monocrystalline alumina) fitted the criterion of transparency.

The objective of this systematic review was to present the contemporary knowledge on translucent orthodontic archwires.

2. Material and methods

The following inclusion criteria were laid down, namely: (1) whether the orthodontic archwires were transparent or translucent, (2) what their production method was, and (3) what physical properties they had. To which the following exclusion criteria were following: (1) coated esthetic archwires, (2) repetitive publications (3) language limitations: papers not written in English. The following databases were screened: Medline (via PubMed), Scopus, Embase and Ovid (from 1970.01.01 to 2016.02.01) (Fig. 1).

The search strategy combined MeSH heading words with free-text words. The main search terms used were ''orthodontic and (wires or archwire) and (transparent or translucent or esthetic or esthetic)''. The titles and abstracts were read to find eligible studies and thus their full texts were obtained. A customized data form was elaborated including the first author's name and year of publication; materials; manufacturing process; wires testing. The references in retrieved studies were also checked. The manual search was performed in selected orthodontic journals: *American Journal of Orthodontic and Orthopedics, Angle Orthodontist, European Journal of Orthodontics (from 1995 to 2016.02.01)*.

3. Results

Finally, 22 papers were chosen for a systematic review (Fig. 1), and 6 papers were excluded from the present review (Table 1). Included papers were divided into two categories: commercially available (Table 2) and those at the development stage (Table 3).

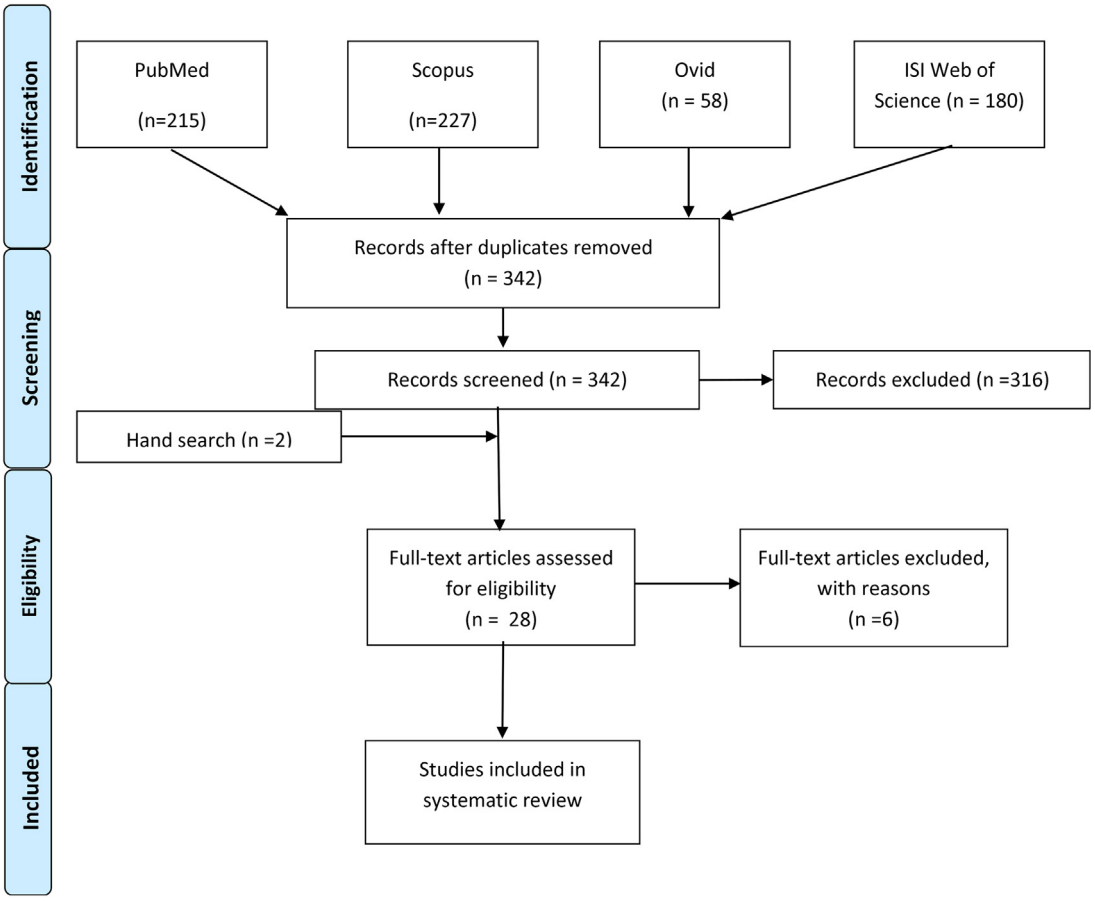

Fig. 1 – Prisma diagram.