Prosthodontic rehabilitation of amelogenesis imperfecta affected anterior region teeth by using veneer restorations

Greta Rutkauskaitė[1], Aušra Baltrušaitytė[2]

[1] Faculty of Odontology, Lithuanian University of Health Sciences, Kaunas, Lithuania

[2] Associate Professor, PhD, Department of Prosthodontics, Lithuanian University of Health Sciences, Kaunas, Lithuania

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Corresponding address:
Greta Rutkauskaitė, Lithuanian University of Health Sciences, Kaunas, Lithuania. E-mail: greta872@gmail.com; telephone number: +370-614-18701. Correspondence address: Aušros str. 20, 44172, Kaunas, Lithuania

Abstract

Background: Amelogenesis imperfecta (AI) is a condition, which affects hard dental tissues, causing aesthetical and functional problems for the patient. One of the possible prosthodontic treatment types is veneer restorations due to their ability to restore the aesthetics and conserve hard dental tissues.

Aim: To review and assess the most recent scientifical literature in order to evaluate the possibility and outcomes of AI affected patients' prosthodontic treatment with veneers.

Methods and materials: Analysis of literature was performed by using the PRISMA protocol. The search was done electronically in ScienceDirect, MEDLINE and Wiley Online Library databases. The focus question was developed by the PICO (population (P), intervention (I), control (C), and outcome (O)) study design protocol.

Results: Out of 303 articles that were found, and 87 records that were screened, 5 articles were included into the qualitative analysis. The vast majority of them were case-reports, and one of them was a retrospective study of multiple patients. Multiple choice materials were reported and used for veneer restorations of the anterior region in AI affected patients.

Conclusions: Veneer restorations is a viable and a recommended method for prosthetic rehabilitation of amelogenesis imperfecta affected patients' hard dental tissues, due to their conservative preparation nature and excellent aesthetics.

Key words:

amelogenesis; imperfecta; veneer; ceramic; rehabilitation

Introduction

Amelogenesis imperfecta is a condition, which usually affects the patients' enamel, along with some other intraoral, extraoral and dental tissues [1]. The rate at which this disease occurs was found to be 1.3:1000 [2]. The disease itself is classified into 4 different types: linked to molecular basis, due to biochemical outcome, associated with the inheritance and according to the phenotype [3]. Clinically AI can be divided into 4 forms: hypoplastic, with reduced thickness, but hard and translucent enamel; hypocalcified, showing normal in thickness, but weak in structure enamel, which appears to be chalky during examination; hypomaturation form, with normal thickness but mottled and softer than normal enamel and hypomaturation-hypoplasia with taurodontism which appear to have both hypomaturation and hypoplasia appearance along with an enlarged pulp chamber [4]. Nevertheless, AI causes not just poor dental aesthetics, but can also cause dental sensitivity [5].

Ceramic veneers and their usage have started back in 1930s, by Charles L. Pincus, although it was aimed at building mouth personality [6], rather than treating diseases, like AI. Nevertheless, one of the most successful ways to treat this disease clinically and to restore and achieve a positive treatment outcome is by prosthetic mouth rehabilitation with ceramic veneers [7]. This type of restoration is usually chosen due to its high survivability in patients mouth and conservative preparation protocols, which preserve more healthy dental tissues in comparison to other prosthetic rehabilitation methods [8, 9]. Another reason, why this type of prosthetic treatment is commonly used, is the longevity of the restorations and high survival rates, going up to 94.4 % after the first five years of treatment [10]. Nevertheless, ceramic veneer restorations have many viable preparation options, which should be considered by the clinician for every clinical case individually [10]. Although in some cases, to achieve the best possible aesthetical and functional treatment result, other manipulations and techniques, including orthodontic pre-treatment, endodontic and periodontic treatment, and sometimes dental surgery have to be included into the final full-mouth prosthodontic rehabilitation treatment plan [11, 12, 13].

The aim of this review was to assess the current literature on AI affected patients' treatment with veneers, and to analyse the possible outcomes after the treatment.

Material and methods

For this review, our aim is to analyse the possible prosthodontic treatment for the patients, by restoring their AI affected dental hard tissues with veneers. This article was done according to the systematic review statement [14].

Focused question:

The focus question was formulated by using the PICO (population (P), intervention (I), control (C), and outcome (O)) study design protocol: Is it possible to achieve an aesthetically and functionally pleasing prosthodontic rehabilitation by using veneers in patients, affected by amelogenesis imperfecta?

Search Strategy:

Analysis of literature was done according to the PRISMA protocol. The following electronical literature databases were used to perform the search: ScienceDirect, MEDLINE and Wiley Online Library. The time period of literature search was 1st of March – 27th of April, 2021. Articles were not older than 5 years old. The keywords "amelogenesis; imperfecta; veneer; ceramic; rehabilitation" and their variations were used. The references of the papers, that were included, were also investigated, in order to identify any potential additional results.

Selection of studies:

The articles were investigated independently by 2 authors. Researchers discussed and compared their selections and matched all the differences through discussion. The screening of all of the articles was done during the final stage. The exclusion of the articles was done after investigation of titles and abstracts.

The decision, whether to include the publication or not, was done after the analysis of the full text, according to the inclusion and exclusion criteria.

Inclusion Criteria:

1. Patient had confirmed AI diagnosis.
2. Prosthodontic treatment was done for the AI affected patient.
3. Veneers were used for AI treatment in the anterior region to preserve dental tissues.
4. AI treatment was described fully, preferably, with a follow-up period.
5. Articles were not older than 5 years old.
6. Articles were in English.

Exclusion Criteria:

1. AI diagnosis was not confirmed.
2. There were no prosthodontic manipulations done in regard to AI treatment.
3. Veneers were not used as one of the methods in prosthetic mouth rehabilitation.
4. Full crowns were chosen instead of veneers.
5. Treatment description was incomplete, lacking a follow-up period.
6. Articles, that were older than 5 years old.
7. Articles, that were written in other than English language.

Data extraction:

The collection of data was done and summarized in the following fields:

1. Authors and year of publication;
2. P - Population/Problem/Sample size;
3. I – Intervention (describes the intervention, that was done to the samples);
4. C – Comparison (describes the control group samples);
5. O – Outcome (describes, whether the outcomes were successful).

Synthesis of results:

The results were synthesized, and all of the findings were put into a table format – Table 1.

Results

Study Selection:

The first initial data search displayed a total of 303 studies. After applying the 5-year filter, 87 studies were screened for eligibility. Out of those studies, the inclusion and exclusion criteria were applied. 12 studies full texts were analysed for eligibility. Seven studies were excluded, due to not using veneers for rehabilitation of AI damaged dental tissues, choosing only full crowns or the full rehabilitation protocol was unclear, also other materials, rather than ceramics, were used for the treatment. 5 studies were included into the qualitative data synthesis, due to their relevance. The flow diagram is shown in Figure 1.

Study characteristics:

The data of interest of the studies, is shown in Table 1. All of the studies have analysed patients, affected with AI, prosthodontic treatment capabilities with veneers and its successfulness. All of the patients described in case reports underwent full mouth treatment including prosthetic veneer restorations on anterior teeth [7, 15-17]. One study analysed multiple patients' treatment with 3 different types of restorations – composite veneers, bonded ceramics and direct resin restorations [18]. Some of the studies suggested ceramic veneers for all the restorations in anterior region, and financial reasons were mentioned as the main reason why composite was chosen as a veneer material in some of the AI damaged teeth [7, 17].

Qualitative synthesis of results:

All of the studies, that were included in this literature review, have described early prosthetic treatment for AI affected patients, by using veneer restorations for their anterior teeth aesthetic smile reconstruction.

In Leung et al. work, which had a 27-year-old male, diagnosed with AI, full mouth prosthetic rehabilitation has been done [15]. Although, at first stages of the treatment, orthodontic appliances were used to stabilise the occlusion by derotating canines and proclining upper incisors, correcting patients crossbite, and to increase space for further prosthetic rehabilitation, so that less enamel would have to be

Table 1.
Synthesis of results.

Study	Year	Population/Problem/Sample size	Intervention	Comparison	Outcome
Leung et al. [15]	2018	27-year-old male with AI diagnosis.	Orthodontic treatment before prosthodontic treatment. Rapid palatal expander and Crozat used for cross-bite correction. Prosthetic treatment: Veneers for lower arch anterior teeth, full-crowns zirconia for upper anterior region, gold crowns for second molars, first molars and pre-molars – PFM restoration.	None.	Successful treatment achieved by using ceramic veneers for anterior part of the prosthetic rehabilitation procedure, with no follow-up period.
Chafaie et al. [16]	2016	16-year-old girl with AI diagnosis.	Orthodontic treatment was done before prosthodontic treatment. Prosthodontic treatment: composite veneers on canines to correct shape and form. Enamel micro abrasion with abrasive paste containing hydrochloric acid (10 cycles for 15 seconds).	None.	Combination of veneers and micro abrasion improved the patients smile aesthetics with non-invasive and minimally-invasive techniques.
Leevailoj et al. [17]	2017	10-year-old boy with AI diagnosis.	Orthodontic treatment before prosthodontic treatment, at 14-years-old (due to open bite). Quadhelix for cross bite and intermaxillary elastics for open bite. Prosthodontic treatment: Full ceramic crowns for posterior region. Anterior region treatment with veneers: ceramic and composite.	None.	Successful treatment achieved by using ceramic and composite veneers for anterior part of the prosthetic rehabilitation procedure. Composite veneers chosen due to budget reasons, would have preferred ceramic.
Shibata et al. [7]	2016	2 cases: Case 1: 17-years-old female. Case 2: 19-years-old female. Both with AI diagnosis.	Case 1: Periodontal procedure: gingivectomy. Prosthodontic treatment: ceramic veneers for anterior region. Case 2: Direct restoration with composite resin.	None.	The selection criteria for the two different mate- rials used in rehabilitation of AI patients can be summarized by the following: 1) disorder type and severity, 2) patient age, 3) esthetic demand, 4) treatment longevity, 5) presence or absence of parafunctional habits, 6) oral hygiene, and 7) financial cost. Proper diagnosis and good treatment planning are fundamental to obtaining a satisfactory result for rehabilitation of patients with AI.

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Table 1. *Continued*

Ohrvik et al. [18]	2019	N=15 subjects with AI diagnosis. Restorations placed N=154. DCR N=44; CBR N=102; PCV N=8.	154 bonded restorations placed. Prosthodontic treatment: ceramic enamel-dentin bonded restorations (CBR), direct composite resin restorations (DCR) and prefabricated composite veneers (PCV).	None.	CDA analysis for all restorations. Observation time from 1 month to 164 months (mean 42.5 month). Long term CBR restorations should be used. PCV should be avoided. DCR could be used as interim restorative therapy.

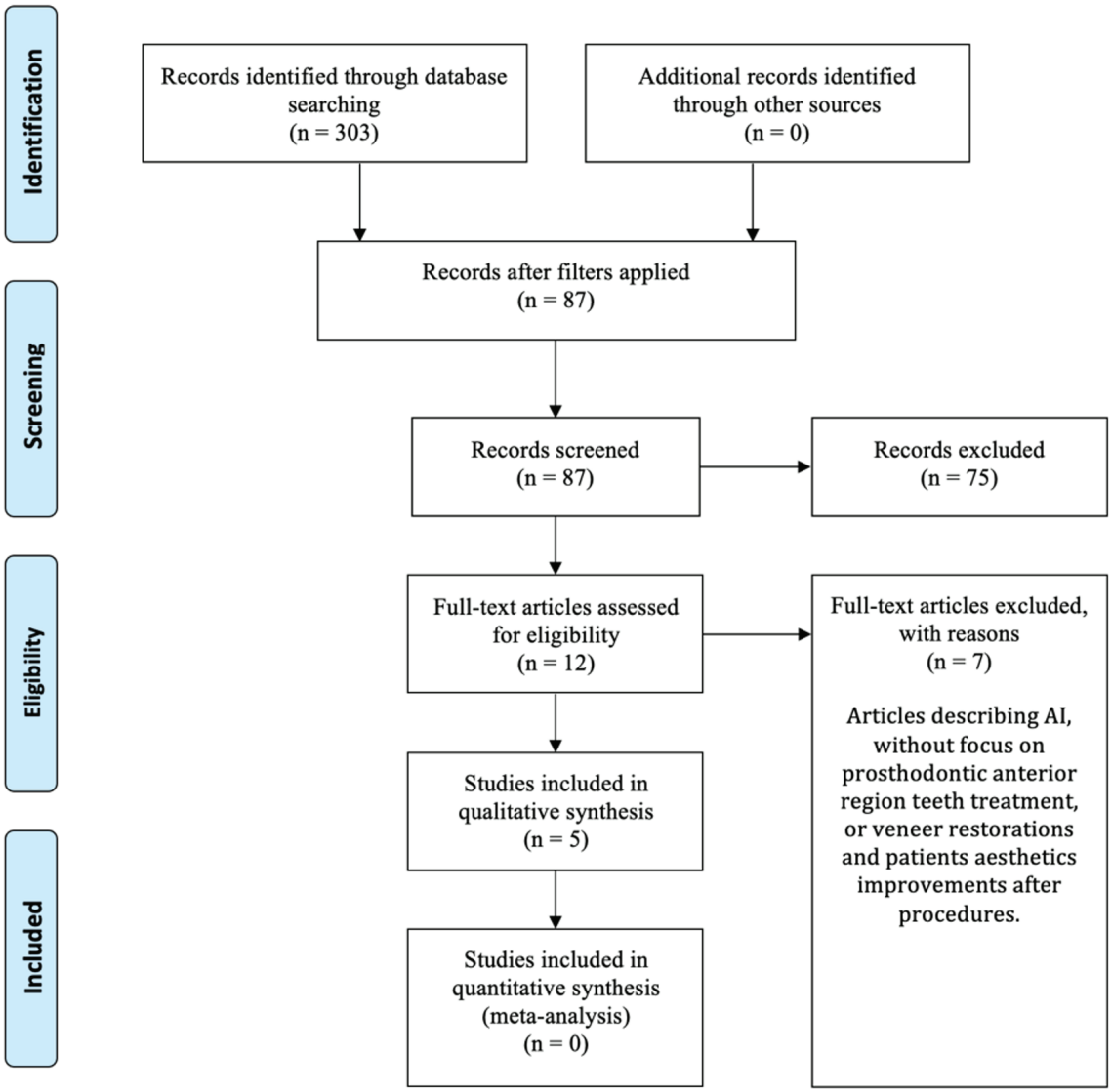

Fig. 1.
PRISMA flow diagram for systematic review

prepared [15]. During prosthodontic rehabilitation, molars and premolars were prepared for full crowns, and anterior lower teeth were prepared for ceramic veneers, in comparison to upper anterior teeth, which were prepared for ceramic crowns. In spite of the increased amount of proteins in AI affected enamel and a negative impact on acid-etching, veneers were cemented and showed the same success as the upper incisors during the review appointment [15].

In comparison, work done by Chafaie et al. described a case of a 16-year-old girl with AI diagnosis, who was in need of an anterior teeth smile makeover due to aesthetical reasons and incorrect shape of canines [16]. The material, chosen for this prosthetic mouth restoration was composite veneers, with no preparation required, so that dental tissues would be preserved. For the central anterior incisors, enamel microabrasion with hydrochloric acid etching was used in 10 cycles for 15 seconds, which had a suitable result for the patient to be happy with her smile aesthetics [16]. This concluded that a successful anterior prosthetic treatment can be achieved by using composite veneers along with microabrasion.

Leevailoj et al. described a case, which required multidisciplinary approach – before prosthetic treatment, 14-year-old-boy had to undergo orthodontic treatment, to correct posterior crossbite and open bite [17]. At 22-years-old, prosthetic treatment was done, with full mouth rehabilitation, and anterior teeth restoration using ceramic and premolar veneers using composite material, in order to save as much dental hard tissues as possible [17]. Although composite veneers were chosen due to limited budget, ceramic veneers would be recommended to all the affected anterior teeth. Nevertheless, treatment was successful, and after 1 year follow-up, no failures were found [17].

The study of Shibata et al. report 2 different AI affected patients prosthodontic cases – one patient (case 1) was treated with porcelain veneers and the other patient (case 2) was treated with direct composite restorations [7]. In the first ceramic veneer case, patient was happy with the results after the treatment, and during follow-up after two weeks, no failures were found, and in the second case, composite resin restorations were used, and a successful mouth restorative result was achieved in the anterior region [7]. Although, it is noted, that the severity of AI in these cases was low, therefore, techniques, which are less invasive, could be used [7].

Orhvik et al. study analysed 154 restorations (44 direct composite resin, 102 ceramic bonded and 8 prefabricated composite veneer restorations), which were applied in 15 AI affected patients [18]. Patients observation period mean was 42.5 months, and all of the types of the restorations were found in place during this period [18]. The types of restorations reported to be the most successful, according to the surface and color calibration success, anatomy and marginal integrity, were ceramic bonded ones (95% success) and it was noted, that all ceramic restorations have demonstrated the most positive results, for the patients with AI diagnosis [18].

Discussion

In this systematic literature review, studies were assessed, describing various cases of patients, affected by AI and their prosthetic treatment by using veneers. The aim of the study was to analyse the most recent cases of AI affected patients' rehabilitation with veneers. In total, 5 studies were used in the qualitative data synthesis, whereas the other ones were excluded due to not meeting the required inclusion criteria.

Although the prosthodontic rehabilitation of AI affected patients is mandatory, it is a complex treatment where a multidisciplinary approach is required, which usually requires intervention of multiple specialists. Orthodontists should be one of the first suggestions due to the ability to recover the smile aesthetics, allowing prosthodontists to apply the least dental tissues damaging technique for further treatment, which enables veneers as a viable choice [15]. In some cases, a periodontal specialist might be needed for a periodontal crown lengthening, although not all patients agree on this type of treatment [17]. Although, these types of manipulations can only be done in patients, who have their periodontal tissues fully matured [19].

Nevertheless, the choice of the restoration is usually one of the most challenging aspects of AI affected patients treatment. Various types of restorations have been suggested, although the most aesthetically challenging anterior region is chosen to be restored with veneer restorations [7, 15-18]. This choice can be made by the thin nature of veneer which allows the conservative preparation approach and also saves dental tissues [7]. Veneers are also a very patient satisfaction ensuring restoration, which in some studies were evaluated up to 100% for the patients satisfaction rate [20]. Although the choice of the restoration material is usually dependent on the financial situation [17]. For posterior restorations of AI affected teeth, full crown restorations are the most common [15, 17]. Prosthodontic full crown rehabilitation is also the most commonly recommended type of treatment for AI affected patients [21].

Further analysis and clinical trials are required, to analyse the differences of veneers and full crowns for the rehabilitation of AI affected teeth, including the choice of materials for these restorations, in order to meet the patients' functional and aesthetical demands and increase the quality of life.

Conclusions

Following conclusions from this systematic review can be drawn:

1. Veneer restorations is an excellent method for the restoration of the hard tissues of AI affected anterior region teeth, due to the conservative preparation nature and unparalleled aesthetical results.
2. Ceramic veneer material was the choice for the most aesthetic result in the anterior region teeth for AI affected patients, although, the financial costs were the highest.
3. Multidisciplinary approach, especially orthodontic and periodontic pre-treatment, is commonly required to achieve successful full-mouth prosthodontic rehabilitation in AI affected patients.

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