

## **ARISTON pHc RESTORATIVE MATERIAL. CLINICAL AND MORPHOLOGICAL STUDY**

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### **A b s t r a c t**

Ariston is a new composite material of white colour indicated for posterior restorations and providing active caries protection. The aim of the present study was to assess the surface appearance of Ariston fillings, marginal adaptation to cavity walls, homogeneity of the filling and the quality of the surface of restorations both clinically and by scanning electron microscopy. A total of 106 restorations were placed in permanent teeth and two restorations were placed in primary teeth. Clinical evaluation was performed after 6 to 25 months according to modified USPHS (United States Public Health Service) standards. Twenty extracted teeth were used for cavity preparation and for investigation of Ariston pHc fillings by scanning electron microscopy. A syringe delivery form of the material was used in ten teeth, ten fillings were prepared from a cartridge delivery form of Ariston. Surfaces of ten Ariston fillings were assessed at 12 and 24 months after restoration both clinically and by means of the replica technique. Clinically, no change in surface quality was found but marginal discoloration appeared in ten cases. The loss of anatomical shape was observed in two fillings and tooth of marginal adaptation was detected in two cases without any caries in the defect. No secondary caries was observed. The results of scanning electron microscopy (SEM) demonstrated that the surface of Ariston, if carefully polished, was very smooth without marginal gaps. Occasional bubbles were found in the material when the syringe delivery form was used. Adaptation to the cavity wall was found to be very good, however, narrow gaps between the filling and the cavity floor were observed in six cases. The replica technique did not reveal any changes along cavosurface margins of the fillings. In the clinically assessed defects, no caries was confirmed by the replica technique. Our results demonstrated that Ariston pHc is a promising material suitable for posterior restoration.

### **Key words**

Composite material, Aesthetic filling, Smart filling, Dental material, Scanning electron microscopy, Morphology, Replication

### **INTRODUCTION**

The offer of restorative materials used for the posterior region includes amalgam, composites, compomers and glassionomer cements. None of them has been found to be fully acceptable. In recent years, a new composite material based on different kinds of dimethacrylates and containing a mixture of inorganic fillers has been introduced on the market. The advantage of this restorative material is that it releases fluoride, calcium and hydroxyl ions to the surroundings of the

filling and thus provides additional caries protection.. Ariston pHc is white in colour and belongs to aesthetic fillings indicated for posterior restorations. The aim of the present study was to assess the surface quality of Ariston pHc fillings, marginal adaptation to cavity walls, homogeneity of the filling and changes in the surface at various intervals after filling placement.

## MATERIALS AND METHODS

### CLINICAL EVALUATION

In the clinical part of the study, a total of 106 Ariston pHc fillings were placed in permanent teeth and two restorations were placed in primary teeth. The restorations were performed in 64 patients and comprised 92 Class I, ten Class II and two Class V restorations (Black's classification) and four restorations of a hypoplastic defect. The distribution of fillings in primary and permanent dentitions in men and women is presented in *Tables 1 to 3*. The surfaces of fillings were assessed at 6 to 25 months after restoration both clinically and morphologically. Morphology was assessed in 20 replicas made from Epon 812. Clinical evaluation was performed according to modified USPHS criteria (1) and included the anatomical shape of the filling, marginal adaptation, marginal discoloration, colour stability and caries occurrence.

### SCANNING ELECTRON MICROSCOPY (SEM)

Twenty extracted teeth were used for SEM investigation. Cavities of class I and II were prepared and filled with Ariston according to the producer's recommendation. The syringe delivery form of material was used in ten teeth, ten fillings were prepared from the cartridge delivery form of Ariston. The surface of the fillings was carefully polished after polymerisation. The teeth were cut with the finest diamond bur both in buccolingual and mesiodistal directions and the dissected teeth were dried, gold – coated and investigated in a Tesla BS 300 scanning electron microscope.

A silicon rubber impression material (Stomaflex) was used to take impressions of Ariston pHc restored teeth at 12 and 24 months after the restoration placement. The impressions were poured with Epon 812 embedment material. The samples were gold-coated and investigated in a Tesla BS 300 scanning electron microscope.

## RESULTS

All restorations were evaluated as acceptable, with the exception of two fillings with defective marginal adaptation in which a small loss of the material was recorded (*Table 4*). Two cases showed a loss of anatomical shape. Ten cases of marginal discoloration were recorded and no secondary caries was detected. The smoothness of the surface remained excellent in all cases (*Figs. 1–6*). In one case, the filled tooth showed temporarily increased sensitivity to filling placement. SEM investigation demonstrated that the margins of Ariston pHc fillings were very well adapted to the cavosurface margins of cavities. No gaps were found along their borders (*Figs 11, 12*). The unpolished areas of fillings showed very irregular and rough surfaces (*Fig. 10*) while polished surfaces were found to be very smooth; the margins of fillings were adapted to the cavosurface outlines of cavities without any visible gaps (*Figs 11, 12*). Sometimes, it was very difficult to identify the exact border of the filling. Adaptation to the floor and walls of the cavity was also very good (*Figs 7, 8, 9*). In six cases, narrow gaps

Table 1

Distribution of fillings in the whole group

Permanent dentition																			Primary dentition		
Tooth	18	17	16	15	14	13	23	25	26	27	48	47	46	45	44	43	33	35	36	37	75
Number of fillings		4	8		2	1	1		6	8	2	18	8	2		1	1	6	22	16	2

Table 2

Distribution of fillings in men

Permanent dentition														Primary dentition
Class I													Class II	Class I
Tooth	17	16	15	25	26	27	47	46	45	35	36	37	14	75
Number of fillings	4	4				4	12		2	2	10	10	2	2

Table 3

Distribution of fillings in the permanent dentition of women

	Class I												Class II	Class V	Hypoplastic defects, vestibular surfaces						
Tooth	18	17	16	25	26	27	48	47	46	35	36	37	47	35	36	37	37	13	23	33	43
Number of fillings			4		6	4	2	4	8	2	10	2	2	2	2	2	2	1	1	1	1

Table 4

Filling quality evaluation

Characteristic	Number of cases
Anatomical shape of the filling loss of the material	2
Marginal adaptation gap	2
Marginal discoloration	10
Secondary caries	0
Hypersensitivity	1
Smoothness of the surface excellent	All

between the filling and the cavity floor were observed (*Figs 7, 8*). In the syringe delivery form, bubbles of different sizes were frequently found, both in the material (*Fig. 7*) and between the filling and the cavity wall. In the cartridge delivery form, no bubbles were identified either in the filling or along the cavity walls (*Figs 8, 9*).

The replica technique demonstrated no changes in the quality of the surface that was without any defects or porosities (*Fig. 14*). Adaptation of the cavosurface margins of the filling to the enamel was very good, without any detectable gaps (*Fig. 14*). No caries was confirmed by this technique in cases in which a defect was found (*Fig. 13*).

#### DISCUSSION

Many studies have shown that a significant part, i.e., up to 75%, of dental services involves the replacement of existing restorations (2, 3). The cause of so-called secondary caries is most frequently the defective margin of a filling. That is why materials providing additional protection against caries formation have been sought. Ariston is a light-cured filling material indicated for posterior restoration. Its monomer matrix consists of a mixture of dimethylmetacrylates and inorganic fillers include alkaline glass, Ba-Al fluorosilicate glass, ytterbium trifluoride and highly dispersed silicon dioxide. It also contains a catalyst and stabilisers. Its colour is white so that, for aesthetic reasons, it is more acceptable than amalgam. According to the first research reports (4), Ariston is releasing three different types of ions (fluoride, calcium, hydroxyl). The release of these



*Fig. 1*

Ariston pHc restoration of tooth 24, class II, DO cavity (image in a mirror) 12 months after the filling placement. No signs of marginal leakage or fracture.



*Fig. 2*

Filling shown in Fig. 1 at 25 months after treatment. No changes in the filling.



*Fig. 3*

Ariston pHc restoration of tooth 16, class II, MO cavity (image in a mirror). No changes in the filling appearance 12 months after its placement.



*Fig. 4*

Tooth shown in Fig. 3 at 34 months after filling placement, with only insignificant staining in the marginal ridge area. The filling margins and contours without any changes.



*Fig. 5*

Tooth 47, restoration class I, 12 months after filling placement. No signs of restoration changes, no signs of a secondary caries even in an unfavourable environment of active caries affecting tooth 48.



*Fig. 6*

Tooth 16, repeated treatment of a hypoplastic defect with Ariston pHc. A fracture in the filling one year after its placement. No caries in the floor of the defect (see also Fig.13).

ions depends on the pH value. When the pH value in the oral cavity is low due to active plaque, Ariston releases a significantly higher amount of ions than it does with neutral pH values. The ion effects are as follows:

fluoride ions hamper demineralisation, promote remineralisation and inhibit bacterial growth (5),

calcium ions hamper demineralisation and promote remineralisation (6),

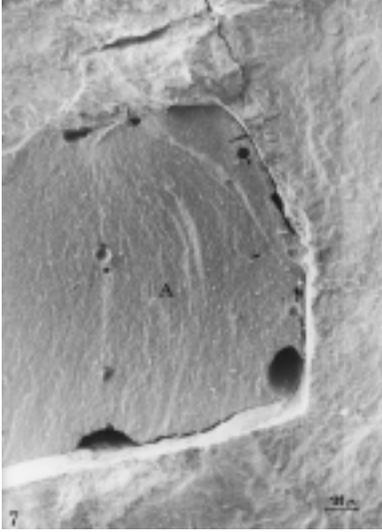
hydroxyl ions neutralise the acid produced by cariogenic bacteria and inhibit bacterial growth (7, 8).

The physical properties of Ariston are comparable to those of fine-particle composites.

Our study concerned with the marginal adaptation of Ariston demonstrated that this restorative material can easily be adapted to cavosurface margins of the cavity without visible marginal gaps. The surface of the filling must be carefully polished to prevent surface roughness. Occasional gaps between the filling and the floor of the cavity are considered to be the result of polymerisation shrinkage of the resin or artefacts produced by sample processing. Bubbles found in the material and between the material and cavity walls may arise by the incremental placement of filling from a syringe. The cartridge delivery form was found to be bubble-free. Marginal defects, which appeared in two fillings, were free of caries. They may have been protected by ion release into the filling surroundings. Marginal discoloration, which was found in several cases, is indicative of leakage in the cavosurface margin area and may have also been caused by a less careful polishing of the marginal region or by polymerisation shrinkage.

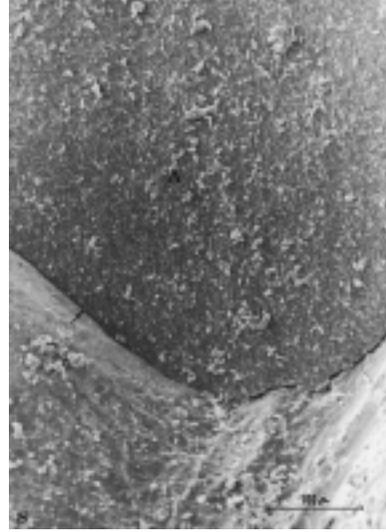
Relevant data in the literature confirm our results that the Ariston pHc restorative material is suitable for both permanent and primary dentitions (9 – 12).

On the basis of our two-year experience we can conclude that Ariston pHc is a promising material for posterior restorations. We can recommend its use especially for the restoration of primary and young permanent teeth; this material does not require the acid-etching technique and thus the danger of dental pulp irritation by phosphoric acid is avoided. The application of Ariston pHc is not time consuming and this may be important in treatment of less cooperative children. Ariston pHc can also be used for preventive filling restorations. However, long-term clinical studies on a larger number of patients should be carried out to confirm the results presented here.



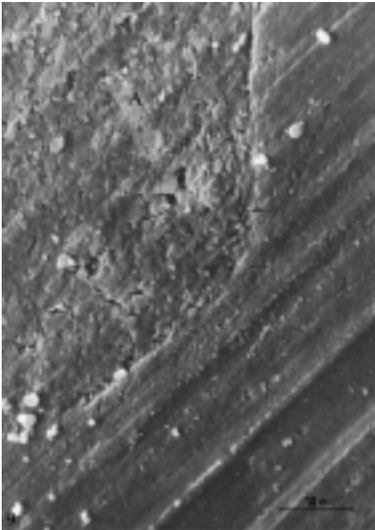
*Fig. 7*

Syringe delivery form of Ariston (A). Bubbles both in the filling (asterisk) and along the filling and the cavity walls. Narrow gap between the filling and the floor of the cavity (arrow).



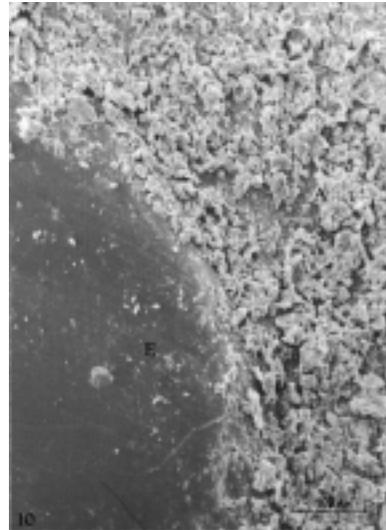
*Fig. 8*

Cartridge delivery form of Ariston (A). No defects in the material, adaptation to the cavity wall without defects, narrow gap between the cavity floor and filling (arrow).



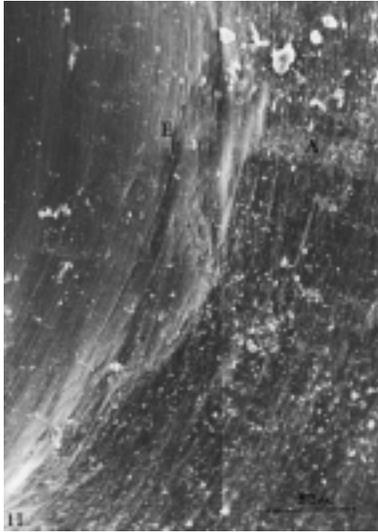
*Fig. 9*

Cartridge delivery form of Ariston (A). No gaps along filling-cavity interface (arrow). Small defects in the filling are obviously artefacts caused by sample preparation.

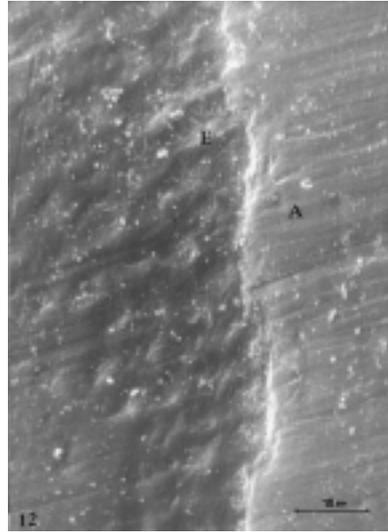


*Fig. 10*

Unpolished Ariston surface displaying many large irregularities. Ariston (A), enamel (E).



*Fig. 11*  
Polished surface of Ariston filling (A), enamel (E). No gaps along the cavosurface margin (arrow).



*Fig. 12*  
Higher magnification of the cavosurface margin, enamel (E), filling (A). Ariston is well adapted to the enamel surface without any marginal leakage.



*Fig. 13*  
Replica of an Ariston pHc restored tooth one year after filling placement. Ariston filling (A), defect (asterisk) in the marginal ridge (M) vicinity, no signs of caries presence (see also Fig. 6) inside the defect.



*Fig. 14*  
Replica of an Ariston pHc restored tooth. No marginal defect along the cavo-surface margin (CS) one year after the filling placement.

KOMPOZITNÍ VÝPLŇOVÝ MATERIÁL ARISTON pHc V KLINICKÉM  
A MORFOLOGICKÉM OBRAZE

S o u h r n

Ariston pHc je nový kompozitní materiál bílé barvy se schopností aktivní ochrany před zubním kazem a je indikovaný k ošetřování distálního úseku chrupu. Cílem této práce bylo zhodnotit povrch Aristonových výplní, adaptaci materiálu ke stěnám kavity, homogenitu výplní a kvalitu okrajového uzávěru výplní jak klinicky tak i v elektronmikroskopickém obraze. Autoři zhotovili celkem 106 výplní ve stálém chrupu a 2 výplně v dočasném chrupu. Klinické hodnocení provedli po 6–25 měsících podle modifikovaných USPHS standardů. Pro vyšetření v rastrovacím elektronovém mikroskopu (REM) bylo použito 20 extrahovaných zubů. Po vypreparování kavity byl použit do deseti zubů Ariston pHc v injekční formě a do 10 zubů Ariston pHc v kompuli. Povrch deseti výplní z Aristonu byl zhodnocen pomocí techniky replikace po 12 a 24 měsících od jejich zhotovení. Při klinickém zhodnocení nebyly nalezeny změny v kvalitě povrchu výplní, marginální diskolorace se objevila u 10 výplní. Ztrátu anatomického tvaru jsme zaznamenali u 2 výplní, marginální adaptace byla porušena ve dvou případech. Ve vzniklém defektu zubní kaz nebyl nalezen. Výskyt sekundárního kazu nebyl v žádném případě zaznamenán. Výsledky v REM prokázaly, že pokud je Ariston pHc pečlivě vyleštěn, vzniká hladký povrch beze spár v okrajovém uzávěru. Při použití injekční formy byly nalezeny bubliny v materiálu. Adaptace ke stěnám kavity byla dobrá, avšak v 6 případech byla zjištěna tenká spára mezi výplní a dnem kavity. Vyšetření zubů pomocí repliky neprokázalo po 12 ani po 24 měsících změny v okrajovém uzávěru. V případě, kdy byl klinicky prokázán defekt ve výplni, nebyl v něm nalezen zubní kaz ani pomocí repliky.

Na základě získaných výsledků můžeme uzavřít, že Ariston pHc je materiál vhodný k ošetřování defektů v distálním úseku chrupu.

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