

CARACTERÍSTICAS COMPARATIVAS DO CRISTALOGRAMA DO FLUIDO ORAL EM PACIENTES USUÁRIOS DE HEROÍNA E METADADONA**COMPARATIVE CHARACTERISTICS OF THE CRYSTALLOGRAM OF THE ORAL FLUID IN PATIENTS WHO USE HEROIN AND METHADONE****СРАВНИТЕЛЬНАЯ ХАРАКТЕРИСТИКА КРИСТАЛЛОГРАММ РОТОВОЙ ЖИДКОСТИ У ПАЦИЕНТОВ, УПОТРЕБЛЯЮЩИХ ГЕРОИН И МЕТАДОН**

SEVBITOV, Andrei*; DOROFEEV, Aleksei; KUZNETSOVA, Maria; TIMOSHIN, Anton; ERSHOV, Kirill

Department of Propaedeutic of Dental Diseases
of I. M. Sechenov First Moscow State Medical University (Sechenov University)

* Correspondence author
e-mail: avsevbitov@mail.ru

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RESUMO

Atualmente, o problema da toxicod dependência é um dos principais problemas, não apenas na área da saúde, mas também na sociedade como um todo, pois representa uma séria ameaça à vida e à saúde da parte saudável da população. As pessoas que sofrem de dependência de drogas são caracterizadas não apenas por distúrbios graves do sistema nervoso central, órgãos internos, mas também por alterações patológicas na membrana mucosa da cavidade oral. Os resultados dos estudos indicam que pessoas que sofrem de dependência de opiáceos (principalmente a dependência de heroína) e que consomem metadona (uma droga sintética do grupo de opioides usados em alguns países como terapia de substituição no tratamento da dependência de drogas), juntamente com os efeitos tóxicos gerais no corpo, há mudanças significativas no estado da dentição. O objetivo do trabalho foi analisar os resultados de cristalogramas dos fluidos orais em pacientes consumidores de heroína e metadona e identificar as características morfológicas dos cristais, dependendo da substância utilizada. Pela primeira vez, foram detectadas alterações na morfologia do cristal em pacientes que consumiam heroína e metadona. O artigo apresenta os resultados de análises de cristalogramas do fluido oral de pacientes em uso de heroína e metadona, características de sua morfologia, características distintas de qualidade, incluindo a falta de crescimento de cristais e ruptura de sua estrutura. Observe-se que tais alterações morfológicas na cristalização do fluido oral de pacientes dependentes de drogas identificadas pela primeira vez e podem ser usadas para fins de diagnóstico em odontologia para identificar pacientes que consomem heroína ou metadona. A análise dos resultados desses cristalogramas nas categorias de pacientes estudadas permitiu diferenciá-los dependendo da substância utilizada (heroína, metadona), que pode ser utilizado na prática clínica.

Palavras-chave: *cristalograma, toxicod dependência, heroína, metadona*

ABSTRACT

Currently, the problem of drug addiction is one of the main not only in healthcare but also in society, because it poses a serious threat to the life and health of the working-age population. Persons suffering from drug addiction, are characterized not only by severe disorders of the Central nervous system, internal organs, but also pathological changes in the mucous membrane of the oral cavity. The results of studies indicate that persons suffering from drug dependence on opiates (mainly from heroin addiction) and taking methadone (a synthetic drug from the group of opioids used in some countries as substitution therapy in the treatment of drug dependence), along with the general toxic effects on the body, there are significant changes in the state of the dentition. The aim of the work is to analyze the results of oral fluid crystallograms in patients using heroin and methadone and to identify the features of crystal morphology depending on the substance used. For the first time, changes in crystal morphology were detected in patients taking heroin and methadone. The article presents the results of the analysis of crystallograms of oral fluid of patients using heroin and methadone, the features of their morphology, distinctive quality features, including the lack of crystal growth and rupture of its structure. It is noted that these morphological changes in the crystallization of oral fluid of drug-dependent

patients identified for the first time and can be used for diagnostic purposes in dentistry to identify patients who use heroin or methadone. Analysis of the results of these crystallograms in the studied categories of patients allows to differentiate them depending on the substance used (heroin, methadone), which can be used in clinical practice.

Keywords: *crystallogram, drug addiction, heroin, methadone.*

АННОТАЦИЯ

В настоящее время проблема наркомании является одной из главных не только в здравоохранении, но и в обществе в целом, поскольку представляет серьезную угрозу жизни и здоровья трудоспособной части населения. Для лиц, страдающих наркотической зависимостью, характерны не только тяжелые расстройства ЦНС, поражения внутренних органов, но и патологические изменения слизистой оболочки полости рта. Результаты исследований свидетельствуют о том, что у лиц, страдающих наркотической зависимостью от опиатов (в основном, от героиновой зависимости) и принимающих метадон (синтетический препарат из группы опиоидов, применяемый в некоторых странах в качестве заместительной терапии при лечении наркотической зависимости), наряду с общим токсическим воздействием на организм, происходят существенные изменения состояния зубочелюстной системы. Цель работы состоит в анализе результатов кристаллограмм ротовой жидкости у пациентов, употребляющих героин и метадон, и выявлении особенностей морфологии кристаллов в зависимости от употребляемого вещества. Впервые обнаружены изменения в морфологии кристаллов у пациентов, принимающих героин и метадон. В статье приведены результаты анализа кристаллограмм пациентов, употребляющих героин и метадон, выявлены особенности их морфологии, отличительные качественные признаки, среди которых отсутствие роста кристалла и разрыв его структуры. Отмечено, что данные морфологические изменения кристаллизации ротовой жидкости у наркозависимых пациентов выявлены впервые и могут быть использованы с диагностической целью в стоматологии для выявления пациентов, употребляющих героин или метадон. Анализ результатов данных кристаллограмм у исследуемых категорий пациентов позволяет дифференцировать их в зависимости от употребляемого вещества (героина, метадона), что может быть использовано в клинической практике.

Ключевые слова: *кристаллограмма, наркомания, героин, метадон.*

1. INTRODUCTION

A direct threat to the nation today is drug addiction, which is becoming an epidemic. 52 million people (1% of the World's population) who systematically abuse drugs are registered in the world. The share of drug addicts coming to the Russian Federation, according to the research Institute of narcology is about 5 million people. Opium addiction is recognized as the most malignant, accounting for 82.9% of the total number of drug addictions (Evstratenko *et al.*, 2018; Martusevich *et al.*, 2014; Mazzeo *et al.*, 2013; Simonova *et al.*, 2014; Timoshin *et al.*, 2018; Vaijayanthimala *et al.*, 2015; Voloshina *et al.*, 2018; Dos Silva *et al.*, 2019). The results of studies indicate that persons suffering from drug dependence on opiates (mainly from heroin addiction) and taking methadone (synthetic drug from the group of opioids used in some countries as a replacement therapy in the treatment of drug dependence), along with the general toxic effects on the body, there are significant changes in the state of the dental system. Drug addicts are characterized by a lack of motivation for a healthy lifestyle, disregard for basic hygiene standards

(daily oral hygiene, a timely visit to the dentist) (Dos Silva, Santos *et al.*, 2019; Gigena *et al.*, 2015; Walter *et al.*, 2015; Yang *et al.*, 2015; Gupta *et al.*, 2012; Mateos-Moreno *et al.*, 2013; Protrka *et al.*, 2013). All this, combined with the General harmful effects of drugs on the state of the body leads to early manifestations of oral diseases (periodontal disease) and more severe course of existing pathologies (caries and its complications) (Du M., *et al.*, 2001; Dukić W, *et al.*, 2013, Vehkalahti M, Nikula-Sarakorpi E and Paunio I., 1996).

Currently, in clinical dentistry, the method of crystallography is used, which consists of the analysis of crystallization figures that are formed when saliva is dried. Among the main morphological features of the crystalline aggregates of mixed saliva are qualitative and quantitative (Du M *et al.*, 2001; Dukić *et al.*, 2013; Vehkalahti *et al.*, 1996; Girardin *et al.*, 2019; Di Fazio *et al.*, 2018; Fiorentin *et al.*, 2018; Cone *et al.*, 2012). The quantitative characteristics include the length of the crystal, the angle of branching, the number of generations of branches of the 1st, 2nd order, the width of the

crystal, the number of microprongs along the length of the crystal. Among the qualitative features, great importance is given to the unevenness of thickness throughout one figure, the asymmetry of branching, the presence of the curvature of the main "trunk" of the crystal, the appearance of crystals with blurred contours, the shape of crystals, the change in the deforming and destructive nature (Kunkel *et al.*, 2015; Grabenauer *et al.*, 2018; Pesce *et al.*, 2012).

Depending on the different pathology of the crystalline structure of the oral fluid is capable of changing orientation (as a result of a breach morphology), which is primarily manifested in the lack of structure (from partial to complete). According to the literature data, studies to determine the structure of crystals in mixed saliva in drug-dependent patients have not been conducted before. In this regard, the study of the features of the crystallography of the oral fluid of drug-addicted patients who use heroin and methadone is very interesting (Rook; 2005).

The aim of the work is to analyze the results of crystallograms of oral fluid of patients using heroin and methadone and to identify the features of crystal morphology depending on the substance used.

2. MATERIALS AND METHODS

All research methods under this article have been conducted in accordance with the relevant guidelines and regulations. All experimental protocols were approved by the Local Ethics Committee of I. M. Sechenov First Moscow State Medical University (Sechenov University). Prior to the study, informed consent was obtained from all patients for the upcoming study.

All patients (110 people: 75 men and 35 women aged 20 to 50 years) in the rehabilitation period of treatment were divided into 2 groups: the first and second main groups. The first major group consisted of 58 heroin users (40 men and 18 women). The mean age of patients was 29.41 ± 1.46 years. The second main group consisted of 52 people (35 men and 17 women) taking methadone as replacement therapy. The mean age of patients was 31.27 ± 1.56 years.

Determination of dental status showed that all patients of the first and second main groups are in dire need of various types of dental care. The control group (35 people: 20 men and 15 women aged 20 to 50 years) consisted of healthy patients who had never used drugs and

methadone. The average age of patients made up 32.81 ± 1.64 years. The study used mixed saliva to study the crystal structures of oral fluid. The material was collected before meals, on an empty stomach. Unstimulated saliva was used. The patient was not recommend smoking, brushing the teeth, drinking heavily, or rinsing the mouth before taking the material for the study. The obtained samples were deposited on the surface of the substrate (the surface for drying the biofluid) with a drop of 0.1 mm. Strictly in a horizontal position, dried at a temperature of 18-25 °C. After drying, the structure of the saliva was examined using a Leica DM-LS optical microscope (Germany) with a Sony DC30P video camera. The resulting image was transmitted to the monitor screen. With a small magnification, an image of the entire surface of the dried drop was scanned, then with a larger magnification, some parts of its surface were examined. The selected areas of the crystallogram were recorded on a computer as a graphic file, Adobe Photoshop 6.0 and PhotoDraw 2000 were used for image processing. The obtained data were entered into an Excel 2000 spreadsheet from Microsoft Office 2000 SR-1 and analyzed with regard to the statistical packages Statistica-5.0 and StatgraphicsPlus 5. To evaluate the null hypothesis, the Student's t-test was used. The results were considered reliable at $p \leq 0.05$.

3. RESULTS AND DISCUSSION:

Comparative characteristics of the qualitative characteristics of crystallogram aggregates of mixed saliva in patients of the control group (%) are presented in Figure 1.

It is noted that these qualitative signs may occur in the morphological structure of mixed saliva of practically healthy patients in different proportions (crystallization of the oral fluid is not strictly the same). The variability in the formation of crystal aggregates of patients of the control group may be due to gender characteristics (the influence of female sex hormones) and mucin heterogeneity. A comparative characteristic of the frequency of detection of qualitative signs of crystallograms of oral fluid aggregates of patients (as a percentage) of the first and second main groups is shown in Figure 2.

According to the presented data, for the patients of the first main group, the following signs prevailed: lack of crystal growth, lack of apex of a crystal, one-sided branching, and uneven thickness throughout one crystal figure ($p < 0.01$). At the same time, in most cases - in 56

people (96.6%), the absence of crystal growth was noted (Figure 3).

In the patients of the second main group in 98% (in 51 people), a break in the crystal structure was observed ($p < 0.01$) (Fig. 4). In 40.4% and 38.5% of cases, branch asymmetry, and the presence of processes of the first generation from the top of the crystal were recorded.

The intake of narcotic substances (heroin) and methadone as a synthetic drug from the group of opioids is having a negative impact not only on the general state of the immune status, the work of the Central nervous system, internal organs and state of homeostasis of the salivary glands, causing gross violations of the morphology of the crystals of the oral fluid (Wasels *et al.*, 1994).

In patients taking heroin, the main morphological feature of crystallograms is the lack of growth. For drug-dependent patients who use methadone, a characteristic feature is the rupture of the crystal structure.

Analysis of the results of these crystallograms in the studied categories of patients allows to differentiate them depending on the substance used (heroin, methadone), which can be used in clinical practice (Presley *et al.*, 2003; Sordi *et al.*, 2017).

4. CONCLUSIONS:

For the first time, changes in crystal morphology were found in patients taking heroin and methadone.

2. For patients who use heroin, according to crystallography, a characteristic feature is the lack of crystal growth; for patients who use methadone – a rupture of the crystal structure.

3. This crystallography technique can be used in clinical practice for the purpose of differential diagnosis in patients using heroin and methadone.

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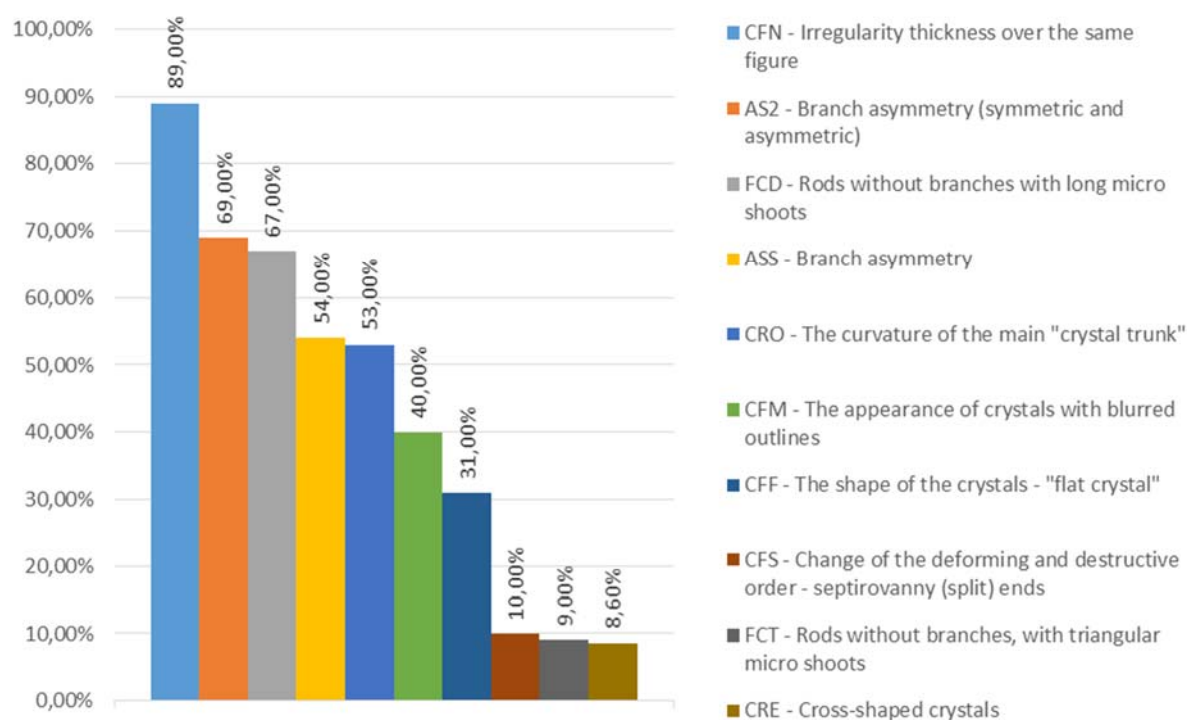


Figure 1. The frequency of occurrence of qualitative signs of crystallograms of oral fluid in patients of the control group as a percentage

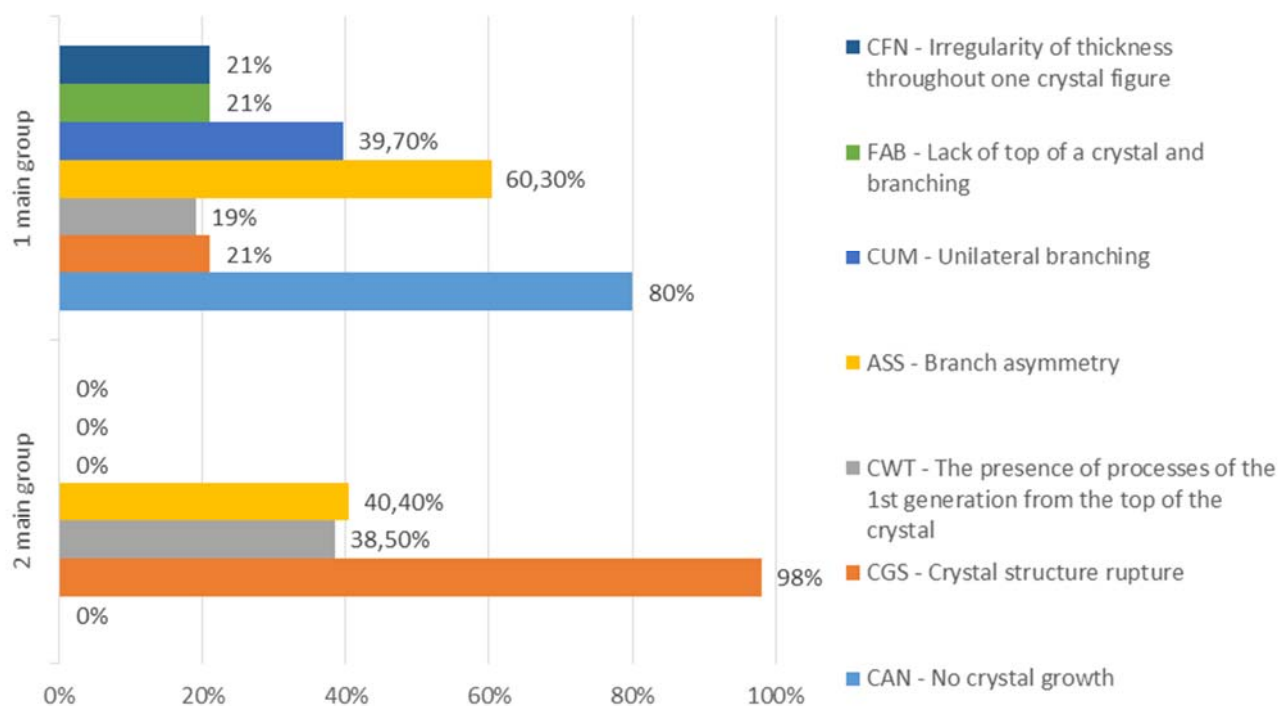


Figure 2. The frequency of detection of qualitative morphological signs in patients of the first and second main groups (as a percentage)

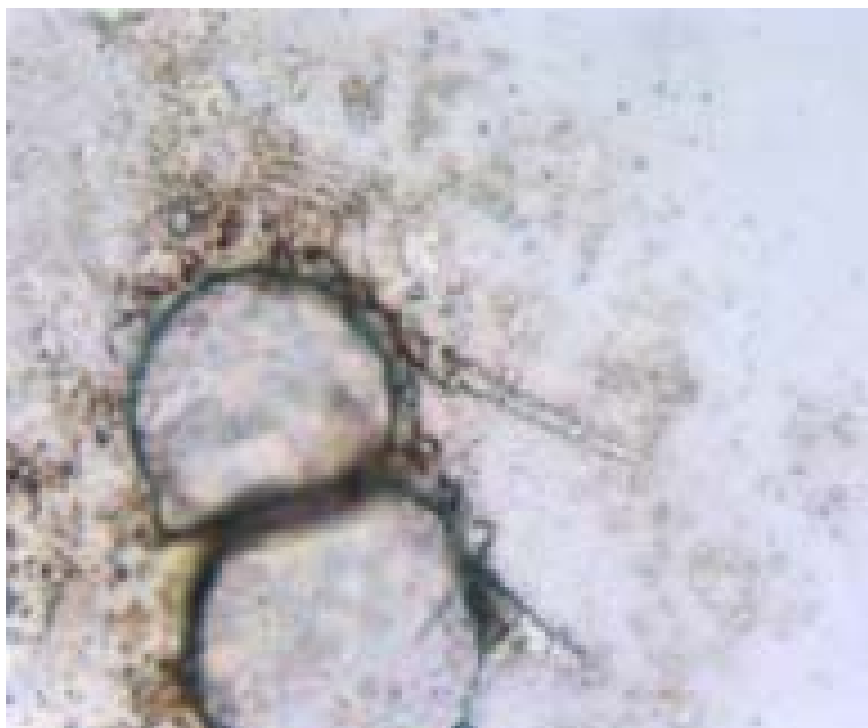


Figure 3. Needle-like short spines, the lack of crystal growth – CAN

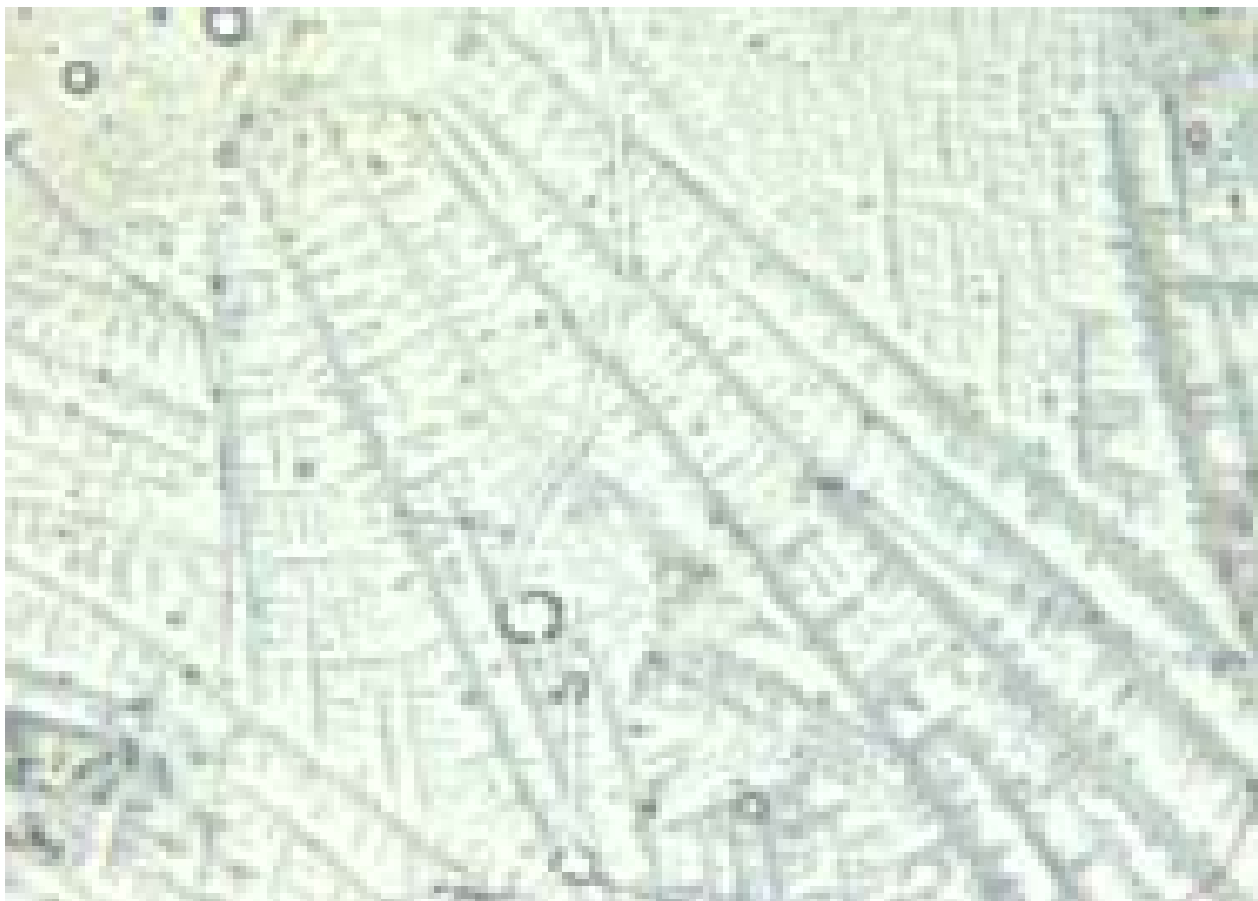


Figure 4. Gap crystal structure – CGS, Appendix 1-generation departs from the top of the crystal – CWT