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*Influence of dental inflammatory processes on CRP concentration  
in blood serum*

C-reactive protein (CRP) was discovered by Tillet and Francis in 1930. CRP belongs to acute phase proteins and is synthesized by liver parenchyma cells (6, 11, 12). C-reactive protein is present in the plasma of healthy people, and its level ranges between 0–10 mg/l (3, 12). Various agents such as a physical injury, bacterial or virus infections, postoperative states, and burns cause an early, unspecific, complex systemic reaction referred to as an acute phase response, manifesting itself with massive increase in the production of many types of proteins, including C-reactive protein. CRP concentration in blood serum rises after 6–8 hours, sometimes already 2 hours after the moment of pathogenic agent action. The presence of CRP in blood serum considerably outstrips the occurrence of accelerated erythrocyte sedimentation rate (1, 4, 5, 10). CRP concentration testing is particularly important in early diagnosing of inflammatory conditions, therapy effectiveness assessment, as well as monitoring and prognosticating of many diseases. CRP is considered to be a sensitive indicator, implying the presence of an inflammatory process and reflecting its intensity. The normalization of CRP concentration is an evidence of a patient's recuperation (2, 7, 12).

The aim of the study was to determine whether there is a cause–effect correlation between CRP concentration and the type and number of chronic dental inflammatory processes foci.

MATERIAL AND METHODS

The study was conducted on 56 patients from dental surgery outpatients' clinic. The examinations were performed on the patients with chronic, asymptomatic dental inflammatory processes in the area of periapical tissues, only detected roentgenographically (those lesions included chronic fibrous, granulomatous and suppurative periapical tissues inflammation). The studied group consisted of 23 women and 33 men. The average age was 50 years. All the patients were informed about the aim of the study and gave their consent in writing to blood sampling. From the studied population there were excluded patients with systemic diseases (autoimmunologic, metabolic ones, diseases that coincide with hepatocellular damage), and with local inflammatory conditions in the oral cavity of non-dental etiology, as well as with inflammatory processes in the parodontium. The clinical diagnosis was based on the history taken from the patients, and the results of intra- and extraoral clinical dental examination. For diagnostic purposes panoramic tomography scanning of the facial skeleton was done to all the examined patients, and intraoral x-rays of individual teeth to some of them. Tooth pulp vitality was determined by examining its reactions to thermic stimuli, electric current, and diagnostic

drilling of the tooth was performed when necessary. The level of CRP concentration was examined before the beginning of oral cavity sanitation. The surgical treatment consisted in: extraction of teeth which could not be treated conservatively; surgical extraction of the roots; surgical removal of dental root cysts, granulomas left over after tooth extraction, and amputation of root apices together with periapical lesions.

The follow-up examination was conducted six weeks after the end of oral cavity sanitation. The control group consisted of 22 people who had vital pulp in all their teeth. CRP concentration values in the control group were determined only once.

CRP was determined by immunoturbidimetric assay, using the set of Cormay CRP produced by Cormay company in Cobas Mira analyzer manufactured by Roche company. The analyzer showed CRP concentration values in mg/l, and the assay error did not exceed 5%.

The calculations were made using the programme Statistica on IBM PC. The level of statistical significance was  $p < 0.05$ . In the studied group five features were identified in order to analyze the influence of their presence on CRP concentration levels. Those features included: the number of dead teeth never treated with root canal therapy, the number of granulomas, the number of cysts, the number of teeth with adequately filled root canals, the number of teeth with inadequately filled root canals. When investigating the relationships between particular parameters Kendall's tau correlation coefficient and Z-value were calculated, determining statistical significance of a particular relationship.

## RESULTS

The correlations between the number and kind of chronic dental inflammatory processes and CRP concentration level in the blood serum of the patients with chronic dental inflammatory processes were presented in Table 1.

There was observed a statistically significant relationship (Kendall's tau correlation coefficient 0.218912;  $Z = 2.243184$ ;  $p = 0.024885$ ) between the number of teeth with dead pulp never treated endodontically and CRP concentration in blood serum (Table 1).

No statistically significant relationships (Kendall's tau correlation coefficient  $-0.06051$ ;  $Z = -0.62003$ ;  $p = 0.535235$ ) were observed between the number of periapical granulomas and CRP concentration in blood serum (Table 1).

No statistically significant relationships (Kendall's tau correlation coefficient 0.086737;  $Z = 0.888786$ ;  $p = 0.374118$ ) were found between the number of cysts and CRP concentration in blood serum (Table 1).

There was a statistically significant relationship (Kendall's tau correlation coefficient  $-0.29587$ ;  $Z = -3.03173$ ;  $p = 0.002432$ ) between the number of teeth adequately filled endodontically and CRP concentration in blood serum (Table 1). In the case of larger number of teeth adequately filled endodontically there were lower levels of CRP concentration in blood serum.

There was a statistically significant relationship (Kendall's tau correlation coefficient  $-0.2234$ ;  $Z = -2.28918$ ;  $p = 0.022069$ ) between the number of teeth inadequately filled endodontically and CRP concentration in blood serum (Table 1). This means that in the case of the presence of a larger number of teeth inadequately filled endodontically there were lower CRP concentration levels.

Table 1. The correlations between the number and kind of chronic dental inflammatory processes and CRP concentration level in the blood serum of the patients with chronic dental inflammatory processes

Correlation	Kendall's tau correlation coefficient	Z value	p level
Relationships between the number of teeth with dead pulp not treated endodontically and CRP concentration level	0.218912	2.243184	0.024885
Relationship between the number of periapical granulomas and CRP concentration level	-0.06051	-0.62003	0.535235
Relationship between the number of cysts and CRP concentration level	0.086737	0.888786	0.374118
Relationship between the number of teeth adequately treated endodontically and CRP concentration level	-0.29587	-3.03173	0.002432
Relationship between the number of teeth inadequately treated endodontically and CRP concentration level	-0.2234	-2.28918	0.022069

## DISCUSSION

The analysis of interrelations between various types of chronic dental inflammatory processes occurring in patients and CRP concentration in blood serum provided a lot of information of diagnostic and clinical importance. A statistically significant relationship was found between the number of teeth with dead pulp never treated with root canal therapy and CRP concentration assessed before assanation of the oral cavity in patients with chronic dental inflammatory processes; the higher the number of teeth with dead pulp never treated with root canal therapy, the higher CRP concentration level. There was also revealed a statistically significant relationship between the number of teeth with dead pulp never treated with root canal therapy and the difference in CRP concentration. A correlation was also found between the number of teeth after adequate root canal therapy and CRP concentration. The presence of a larger number of teeth adequately filled endodontically means the occurrence of lower CRP values. There is a correlation between the number of teeth inadequately filled endodontically and CRP concentration; the more teeth with inadequately filled canals there were, the lower CRP concentration values paradoxically appeared to be. That fact may suggest a minimal impact of this condition on a possible result of increase in CRP concentration in blood serum in the situation of preserving sterility of the root canal that has no traces of dead pulp. No statistically significant relationship was found between the number of periapical granulomas or cysts and CRP concentration. Therefore, it may be assumed with large probability that in the case of cysts, until a certain moment, connective tissue capsule limiting the extent of the lesion gives the cyst autonomous character, for periapical granulomas, however, bone tissue creates a certain barrier against the penetration of inflamed cells. In available reference materials there are two reports which may correspond with the assumptions of our study. Increase in CRP concentration in blood serum in patients with an acute inflammatory process of chronic periapical granulomas was observed by Marton et al. CRP concentration in those patients in the initial examination was elevated (ranging between 6.6+/-4.2 mg/l) in comparison to the examination results in the control group (5.00 mg/l). Three months after endodontic and surgical treatments CRP concentration fell to the values 3.9+/-1.8 mg/l (8, 9).

## CONCLUSIONS

1. Chronic dental inflammatory processes cause increase in CRP concentration in blood serum.

2. CRP performs the function of an indicator, is a sensitive laboratory parameter in the course of chronic dental inflammatory processes.

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## SUMMARY

CRP concentration in blood serum of patients with chronic dental inflammatory processes was determined. The aim of the study was to establish whether CRP concentration depends on the number and type of chronic dental inflammatory processes. The study has shown that the larger the number of teeth with dead pulp not treated with root canal therapy the higher CRP concentration. The higher number of teeth after adequate or inadequate root canal therapy results in lower values of CRP concentration. No statistically significant relationships between CRP concentration and the numbers of cysts and granulomas have been found.

## Wpływ zębopochodnych procesów zapalnych na stężenie CRP w surowicy krwi

Autorzy oznaczali stężenie CRP w surowicy krwi pacjentów z przewlekłymi zębopochodnymi procesami zapalnymi. Celem pracy było stwierdzenie, czy stężenie CRP zależy od liczby i rodzaju przewlekłych zębopochodnych procesów zapalnych. Przeprowadzone badania wykazały, że im większa była liczba zębów z martwą miazgą nieleczonych endodontycznie, tym stężenie CRP było wyższe. Większa liczba zębów prawidłowo wypełnionych endodontycznie jak i nieprawidłowo wypełnionych endodontycznie powoduje występowanie niższych wartości stężenia CRP. Nie stwierdzono natomiast istotnych statystycznie zależności pomiędzy stężeniem CRP a liczbą torbieli i ziarniaków.