REPORT TO THE NATIONAL ACADEMY OF DENTAL SURGERY

INFECTIOUS COMPLICATIONS OF ARTICULAR PROSTHESIS AND BUCCO-DENTAL INFECTION

Professor M. GUILLAIN, President of the Academy.
Professors B. TOMENO and J. P. COURPIED, orthopedic surgeons
Professors Y. COMMISSIONAT and G. PRINC, dentists
Doctors R. MOATTY, F. BOUKHOBZA and N. AL-ZRIQAT, odontologists

One of the major developments in postwar surgery was the replacement of seriously deteriorated articulations with articular prostheses.

The practice of mounting articular prostheses is currently met.

Nevertheless, the infectious complications at the level of the articular prostheses still raise problems. In effect, the consequences may be disastrous. We can arrive to the point of changing the prosthesis, if that’s possible. In the contrary case, after the retraction of the prosthesis without replacement, a pseudoarthrosis appears and triggers a skeletal deficiency, shrinkage of the limbs and an important physical deterioration (Salvati 1984).

In the worst case, the infection of an articular prosthesis may lead to a chronic osteomyelitis which can cause amputation or death.

We can distinguish between primary and secondary infections.

- the primary infections appear within less than two months after the replacement of the articular prostheses. They are due to post-operatory contamination. They are the most frequent. Yet, due to the use of the pre-operatory antibioprophylaxis, on one hand, and of the evolution of techniques on the other, their incidence decreased during the last two decades.
- The secondary infections, due to bacteria coming from distant infectious sites: bucco-dental, urinary, oto-rhino-laryngological, respiratory, cutaneous or others.

It is crucial to identify this possible bucco-dental etiology in order to come up with strict therapeutic rules.

Orthopedic surgeons, odontologists and dentists are perfectly aware of the risk, but this risk is difficult to assess, even more difficult in the case of infectious endocarditis. This latter affection has made the object of two conferences in the field, one in March 1992, the other revised in 2002.

This difference in evaluation comes from several factors.

The endocarditis appears at patients who show a previous cardiopathy; the mounting of valvular prostheses does nothing but increase the risk. On the contrary, the mounting of articular prostheses is often conducted on patients who show no general pathology.
Moreover, if the bacteriological evidence is difficult to evaluate in the presence of an endocarditis, it is infinitely more difficult to assess in the presence of an infection around an articular prosthesis.

It results that the medical literature, so abundant in the case of endocarditis, is scarce in articular matters.

These facts impact on the relationships between the orthopedic surgeons and odonto-dentists. The former require the latter to search and eliminate all infectious dental sources, patent or latent. The latter are caught between two fires: they either enlarge the indications and suppress, except obvious sources, all suspect sources, thus edentating a patient maybe too much and for no good reason, or they are more economical and see, in case of an articular infection, their responsibility challenged.

There has to be drawn a separation between three categories of patients:
- research of infectious sources of dental origin prior to the mounting of an articular prosthesis
- dental treatments appeared after a buccal-dental infection at a patient carrier of an articular prosthesis
- around an articular prosthesis. Research of a possible bucco-dental etiology.

**RESEARCH OF INFECTION SOURCES OF DENTAL ORIGIN PRIOR TO THE MOUNTING OF AN ARTICULAR PROSTHESIS**

The 1997 conference of the American Dental Association and the American Academy of Orthopedic Surgeons simply suggests:

“The patients who need the mounting of an articular prosthesis must have a good dental health before the intervention and should be encouraged to solve their dental issues if necessary”.

These directives are vague and force us to turn to those issued for the infectious endocarditis with a corrective capital. We shall further see the rarity of articular infections not certainly but probably of dental origin and the difficulty to prove it. That’s why it seems to us that we should keep the broad lines of the directives issued for the endocarditis but apply them with less severity.

There are two categories of patients: patients without risks and patients with a risk of infection on articular prosthesis.

**Patients without risks:**

They are patients who, beside their articular pathology, do not show any general pathology.

There is no counter-indication for non hemorrhagic dental acts (Table 1).

<table>
<thead>
<tr>
<th>Acts of prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>- application of fluoride</td>
</tr>
<tr>
<td>- sealing of fissures</td>
</tr>
<tr>
<td>Conservative care (coronary restauration)</td>
</tr>
<tr>
<td>Non hemorrhagic prosthetic care (plaster cast)</td>
</tr>
<tr>
<td>Mounting of orthodontic removable prosthesis</td>
</tr>
<tr>
<td>Mounting or adjustment of orthodontic devices</td>
</tr>
</tbody>
</table>

For the hemorrhagic acts the attitude should be as follows:

**Two general rules:**

- the antibiotic treatments have the same indications as in the case of a fault free patient
- it would be advisable to apply the general rule of a mouth wash with a chlorexidine based solution for 30 seconds before the dental intervention.
Detailed indications:

- Contrary to the rules indicated when confronted with a risk of endocarditis, the edodontic care can be thought of. Ideally, the care should be done at least 3 months prior to the intervention on the articulation to follow the treatment evolution and extract the tooth in case of an infectious complication. We remind the fact that the interventions of orthopedic surgery are not necessarily urgent and collaboration between the odontologist and the surgeon avoids ill-timed acts.

- Retake of radicular treatments: the same rules may be admitted

- Pulped teeth with perfectly treated channels. DESCROZAILLES doesn’t consider as an infectious source a tooth having suffered a correct channel obstruction more than a year before and which shows no periapical lesion

- Pulped teeth with channels not treated totally. It seems to us possible to be relatively indulgent on condition that the treatment lasts for more than one year and a minute examination shows no periradicular lesion

- Peri-apical surgery: it would be great to perform it 3 moths prior to the mounting of an articular prosthesis. The tooth can be kept if after such delay there is a hint of calcification, if not, it needs to be extracted.

- Parodontal care. THYNE and FERGUSSON insist on the role of the parodontal malady as factor of articular infection. The tartar removal doesn’t pose any problems, on the contrary, as the prognostic of parodontal surgery acts is not always assured, the extractions have broad indications.

- Irrecoverable teeth: to be extracted

- Teeth included in an open pericoronary sack: to be extracted

- Dental implants: the articular prosthesis is a foreign body similar to an implant, but this foreign body is completely buried in the organism, while the dental implant communicates with the oral cavity. The apparition of a peri-implantitis is unpredictable. Abstention should be the rule.

- Trauma: extra-cameral coronary fractions do not raise any problems. The endodontic treatments will be conducted conforming to the above mentioned directives. Radicular fractions will need extraction. Reimplants should be discouraged.

Patients with risks:

Their list is to be found in the table below:

<table>
<thead>
<tr>
<th>Patients with general pathologies such as:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Insulin dependant diabetes</td>
</tr>
<tr>
<td>- Malnutrition.</td>
</tr>
<tr>
<td>- Hemophilia.</td>
</tr>
<tr>
<td>- Cancer</td>
</tr>
<tr>
<td>- AIDS</td>
</tr>
<tr>
<td>- Kidney failure</td>
</tr>
<tr>
<td>- Heart failure</td>
</tr>
<tr>
<td>- Liver failure.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Immuno-depressants patients: immuno-depression gained, constitutional or therapeutic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rheumatic arthritis (rheumatoid polyarthritis, crythematosus lupus …)</td>
</tr>
<tr>
<td>- Long term intake of medicine (cortical therapy, chemo therapy…)</td>
</tr>
</tbody>
</table>
It is obvious that the directives are too strict.
- the antibiotic treatments have too broad indications
- the endodontic care is inspired from the rules issued for endocarditis: treatments carried out under surgery, in one sitting, on perfectly accessible channels (monoradicular)
- intake of radicular treatments, periapical surgery: counter-indicated
- pulped teeth with perfectly treated channels: to keep according to the norms of DESCROZAILLES.
- Pulped teeth with channels not totally treated: extraction
- Parodontal care: no parodontal surgery

DENTAL TREATMENTS APPEARED AFTER A BUCCO-DENTAL INFECTION AT A PATIENT CARRIER OF AN ARTICULAR PROSTHESIS

After the conference held by the American Dental Association and the American Academy of Orthopedic Surgeons, the antibiotic prophylaxis is not indicated in the case of patients carriers of plaques and screws or in the case of patients carriers of articular prosthesis.

The risks of antimicrobial therapy are well known: digestive problems, toxicity, allergy, development, selection and transmission of a microbial resistance.

The reports risks/benefits and cost/efficiency do not justify such a prescription. The comparison between the articular infection and the infectious endocarditis is not valid, because the anatomy, blood circulation, germs and the mechanism of infection are totally different. Any patient showing an acute oral-facial infection must be energetically treated through the elimination of the source of infection (incisions and drainage, endodontic treatments, extractions) and antimicrobial therapy. Usual signs at the level of the articulation must raise an alarm: tumefaction, pain, fever and temperature.

If the authors blame the systematic antibiotic prophylaxis at the moment of dental treatments, they make an exception for the patients with a risk of infection on the articular prosthesis (see table above).

A new reunion took place in 2003. The conclusions remain the same except for a modification in the classification of patients with a potential risk.

ROTHSTEIN insists on these conclusions and on the distinction between patients with a high risk and the patients with a low risk.

FIELD and MARTIN insist as well on the fact that the antibiotic prophylaxis is not systematically justified.

SEYMOUR and coll. Go a little bit further. The relations between the articular infections and the dental treatments are doubtful and there is no evidence that an antibiotic prophylaxis protects the patients. The relationship between dental treatments which provoke a bacterial disease and the articular infections stands and if an oral germ is involved it may come either from a spontaneous bacterial disease or from a dental infection. The antibiotic prescriptions recommended by orthopedists haven’t been evaluated in a study with control-placebo. There is therefore little reason to institute an antibiotic prophylaxis. Besides, the risk of
prescribing such a prophylaxis is bigger than the risk of an articular infection.

In effect, for SEYMOUR, from 100,000 patients carrying an articular prosthesis, only 30 developed an infection which imposed its replacement.

From another point of view, the prescription of antibiotics would be the cause of 40 cases of anaphylaxis and 4 cases of death.

This statement is confirmed by JACOBSON and coll. According to these authors, the infectious risk is minimum: 29.3 cases for 10(6) dental acts. The risk of death from an oral therapy with penicillin is bigger. The prophylactic antibiotherapy is therefore a costly strategy. The author makes nevertheless certain concessions in particular cases.

LITTLE marks the same reserves with regards to the antibiotherapy because its benefit is not proven and the antibiotics may have side effects. The final decision is taken by the odontologist.

THYNE and FERGUSON have shown in the literature 21 cases of articular infection of dental origin. In only 3 cases a viridians streptococcus was found in the articulation.

The patients showed a marked parodontal malady. These authors quote a study by AINSCOW and DENHAM who followed 1000 patients, carriers of 1112 articular prostheses. No antibiotic was prescribed for covering a dental intervention or surgery. Only 3 patients showed an articular infection associated with an established cutaneous infection.

WAHL goes further in an article called “the myths of the infection of articular prostheses of dental origin”.

The first myth is the similarity with the infectious endocarditis.

The bacteriology contradicts this myth: the viridians streptococcus was found only in 1.6 – 6% of the cases of articular infection. On the other hand, the staphylococcus found in 60% of the cases of articular infection doesn’t form but 0.005% of the oral flora and was not isolated in the acute dental infections.

For the same author, less than 25 cases were recorded to prove these relationships. The physiological causes (mastication, tooth brushing, use of dental floss) provoke more endocarditis than the interventions. Why than accuse the interventions in the articular field?

No animal experiment showed that a bacterial disease of dental origin triggers an infection on the articular prosthesis.

For WAHL, only 0.5% of the patients who carry an articular prosthesis are attacked by an infection after a dental treatment.

The systematic antibioprophylaxis is therefore not justified, for two reasons: the inherent risks and, more importantly for the Americans than the Europeans, its cost. WAHL, following TSEVAT, insists on the countless failures of the antibiotic prophylaxis in the case of endocarditis; therefore it isn’t certain whether the results are better in the articular pathology.

WAHL’s conclusions are final:

“It is now time to stop the practice of antibiotic prophylaxis in order to prevent an articular infection around prosthesis after a dental intervention”.

Other authors seem less hostile against antibioprophylaxis. Their opinion is based
on the results of investigations conducted by various practitioners.

SCHAAF and YODER estimate that there is a menace of infection through hematogens after dental interventions. There is no shared protocol to guide odontologists to determine the methods of treatment. That’s why they carried out an investigation to which 121 orthopedists answered. Most of them recommend an antibiotic prophylaxis in the case of oral surgery, extractions and acute dental infection. The British Orthopedic Association advises on such a prophylaxis when the dental treatment is complex and long termed (more than 45 minutes).

A similar study was made in Great Britain by SANDHU and coll. on 250 dentists and orthopedic surgeons. 77.7% of the dentists recommended an antibiotic prophylaxis and only 29% of the orthopedic surgeons. The authors concluded that the cooperation between the specialties turns out to be necessary in order to set up strict rules.

SCHROUT and coll. conducted an investigation on 110 orthopedic surgeons and 63 odontologists. 9.3% of the former considered that the bacterial diseases after dental infections could affect the articular prostheses as opposed to 75% of the latter. The two groups thought the same about the consultation of the orthopedist before any dental treatment.

98% of the orthopedists are partisans of an antibiotherapy prophylaxis before a dental treatment, as well as for the whole duration of the patient’s life. Certain authors make a difference between the great articulations (knees and hips) and the other articulations for which this rule would be less strict.

NORDEN distinguishes between “ordinary” dental interventions which do not call for antibiotherapy as opposed to periodontal affections or potential dental infections.

**Clinical consequences**

What should therefore be the attitude of the odontologist or the dentist when they have to act on or treat an infectious accident at a subject who carries an articular prosthesis?

**Antibioprophylaxis**

It seems to be rejected by several authors on grounds that its possible inefficiency and side effects may be serious. It must be noted that Anglo-Saxon authors seem to be more troubled by the seriousness of these side effects than the European practitioners.

In reality it seems that it is advisable to prescribe it before any infectious phenomenon of oral dental origin.

Regarding the interventions, it seems pointless, except for complex interventions or long term interventions (more than 45 minutes).

This attitude is valid for the patients without risks. The indications of antibiotics for patients with risks are much broader.

**Nature of the intervention**

The endodontic care may be practical. An antibiotherapy will be instituted at the slightest menace of an infection. The periapical, parodontal surgery, the implants seem to us counter-indicated.
INFECTION AROUND AN ARTICULAR PROSTHESIS. RESEARCH OF A POSSIBLE BUCCO-DENTAL ETIOLOGY.

For SHROUT and coll., the bacteria provoking most of the late infections around the articular prostheses have but few representatives in the oral cavity.

For the Conference of the American Dental Association and American Academy of Orthopedic Surgeons a bacterial disease of dental origin may trigger an articular infection either precociously after the intervention or several years after. The most critical period would appear 2 years after.

SKIEST and COYKENDALL state an observation of the infection of a hip prosthesis following a dental intervention. They remind the fact that the literature could reveal beforehand 21 cases of such an infection.

It was about a man of 39 years of age affected by lupus, treated by corticoids, carrier of a hip prosthesis and showing fever for more than 2 weeks, pain and limitation of movement of the hip. Seven weeks before, algia at the level of the 2nd upper right molar had been extracted. Because of a penicillin allergy, he had taken 2 hours before the extraction 3g of erythromycin and 500mg 6 hours after. Several dental interventions were conducted the following weeks, with an intake of erythromycin before each. The hip prosthesis had been placed ten years before and replaced 5 years later because of an infection with the golden staphylococcus. He was treated with irrigation, drainage and replacement of the prosthesis. The examination would show an oralis streptococcus, part of the viridians streptococcus which was resistant to erythromycin.

According to SKIEST, 1 million people in the US are carriers of articular prostheses. The infection incidence is estimated around 0.5%.

Most of the infections were due to Staphylococci followed by Corynebacterium, hemolytic β and anaerobic streptococci. The viridians streptococci are recorded only in 2% of the cases and only 0.04% of these infections admit a dental etiology. For these reasons, the systematic antibioprophylaxis is not justified for an oral dental intervention except the case of obvious infection. This opinion is confirmed by the Academy of Oral Medicine, The Council of Dental Therapeutics. Despite these recommendations, the author quotes a survey indicating that 93% of the American orthopedists recommend such a prophylaxis.

SEYMOUR and WHITWORTH confirm the distinction between precocious articular infection (within the two months following surgery) and late infection. The precocious infection is the consequence of the surgery; the late one comes from a hematogenic dissemination starting from a distant infectious source.

On the bacterial plan, more than 66% of the articular infections are caused by the staphylococcus and only 4.9% by the viridians streptococcus of possible oral origin.

The authors quote a record of 21 cases of articular infection attributable to a dental act. With one of these patients, the same microorganism was found in the cultures coming from saliva, blood and the articular
prosthesis. It was the hemolytic β streptococcus.

Another study incriminates primarily an infection of the skin and of the soft tissues. In 110 cases, 4 could be attributed to viridians streptococcus. These 4 patients had been victims of a recent acute dental infection.

ROUGERIE was able to record 28 cases of infected hip prostheses.

In 3 cases, the germs identified were certainly not of oral origin: the golden staphylococcus after spondylodiscitis, Escherichia coli, epidermis staphylococcus after the leg ulcer.

The author couldn’t take samples from more than 6 other patients. There was no germ identification except one case: a 21 years old patient, affected by stiff spondylarthritis. A non-classifiable streptococcus was found at the level of a residual lacteal root and at the level of his hip prosthesis. Nevertheless, the antibiograms revealed a different sensitivity to certain antibiotics. From where the following conclusion:

“If certain authors have described clinical cases of late infections of total hip prosthesis, with strong suspicions of oral dental origin, none has recorded absolute evidence in reality”.

**Odonto-stomatological consequences**

It is clear that the infection around an articular prosthesis requires the conduction of a rigorous oral dental examination. The patient will be considered as a subject with risks and treated as such. The indications of extractions are therefore enlarged.

The extractions should be taken advantage of in order to make a bacteriological study of the extracted teeth. The sampling technique through immersion of the apex should be applied (LEPOIVRE, COMMISSIONAT, CHIKHANI and coll.).

One should try to confirm a similarity between the germs at the level of the articular prosthesis and the germs collected at the level of the dental apex.

The antibiotic coverage will be prescribed with the consent of the orthopedic surgeon.

**GENERAL THERAPEUTICAL CONSIDERATIONS**

After the conference mentioned above, the rules of dental hygiene before and after the intervention must be strict: elimination of tartar, manual or electrical brushing, cleaning of contact points, and use of hydropulsers.

We stated the reserves of a good many American authors concerning the antibioprophylaxis.

Still, when the antibiotics are prescribed, mainly in the case of high risk patients, the conference proposes the following scheme in order to classify the dental interventions (Table 3):

<table>
<thead>
<tr>
<th>SITUATION</th>
<th>ANTIBIOTIC</th>
<th>POSOLOGY AND WAY OF ADMINISTRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard prophylaxis</td>
<td>Cephalexin, cephradin or amoxicillin</td>
<td>2g per os one hour before surgery</td>
</tr>
<tr>
<td>Unusable oral way</td>
<td>Cephalozin or amoxicillin</td>
<td>Cephalozin 1g or amoxicillin 2g IM ou IV one hour before</td>
</tr>
</tbody>
</table>

79
Allergy at lactamines B

<table>
<thead>
<tr>
<th>Allergy at lactamines B</th>
<th>Clindamycine</th>
<th>600mg per os one hour before surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allergy at lactamines B and unusable oral way</td>
<td>Clindamycine</td>
<td>600mg IV one hour before surgery</td>
</tr>
</tbody>
</table>

A second dose is not recommended except in cases of infection.

It seems to us that in France it is wiser to rely on the advice issued by the conferences in 1992 and 2002 on the prophylaxis of the infectious endocarditis:
- amoxicillin 3 g one hour before surgery
- in case of allergy at betalactamines: 
  clindamycin 600mg per os one hour before surgery or pristinamycine: 1g per os.

The germs of dental origin are indeed sensitive to these antibiotics.

We should add to the antibioprophylaxis a local pre-operatory antiseptic under the form of a mouthwash chlorexidine based.

BENDER quoted by DECROZAILLES and coll.:

“It was demonstrated that certain local antiseptics based on chlorexidine applied on the gum 3 to 5 minutes before the dental extraction reduce the possibility of bacterial infection after extraction. It is recommended to use them in conjunction with the antibioprophylaxis and not as a replacement of it”.

Post-operatory the patient should be asked to check the temperature the next morning and the following days. In case of abnormally high temperature, the patient has to revisit the orthopedist. Anyways, the patient should be consulted the day following the intervention, In case of normal cicatrisation, no treatment is recommended. In case of late cicatrisation, with blood clots associated to: fetidity, vivid pain, peri-maxillary edema, a complementary antibiotherapy is suggested according to the conference.

“Except certain invasive gestures in an infected spot, it will be necessary to extend the antibiotherapy”.

Moreover, 3g of amoxicillin one hour before surgery will be completed by 1g every 8 hours or 3g for several days until the healing of the operatory wound:
- elimination of all suspect necrotic areas
- disappearance of all fetidity
- disappearance of a peri-maxillary edema

The control of the temperature should indicate a coming back to normal; otherwise the orthopedist must be consulted.

In case of allergy to betalactamines, clindamycine or pristinamycine shall be used according to the same principles.

CONCLUSIONS

For the American authors the infections on articular prostheses are rare: 30 from 100000 carriers of prostheses according to SEYMOUR. For SKIEST, 1 million people in the US are carriers of articular prostheses. The infection incidence is estimated at 0.5%. The dental etiology is even rarer. 29.3 cases for 10(6) dental acts. Since the infection on the articular prosthesis is rare, for these authors it is difficult to prove a link between this infection and a dental etiology. The germs found at the level of the articular prosthesis are rarely considered as factors of dental infection. The streptococci viridians are not found in more than 2% of
the cases and only 0.04$ of them admit a dental etiology. (SKIEST)

For SEYMOUR the incidence of the viridians streptococci is of 4.9% and of 1.6 to 6% for WAHL.

In front of such statistic results the strict rules suggested for the infectious endocarditis should be kept?

It seems to us that for the patients showing no pathology except their articular pathology, these rules should be softened according the scheme mentioned above. On the contrary, at the high risk subjects, the rules must be kept as strict as possible.

Another problem is raised by the American authors. The systematic antibiotic coverage of dental acts at subjects who are carriers of an articular prosthesis provokes in them an ever greater reticence. It is not only useless, but it seems that more Europeans fear the side effects associated with it. They still admit that a large number of practitioners recommend it in the presence of invasive dental acts or in the case of a dental infection.

We recommend in this report the observance by the carriers of articular protheses of the rules elaborated for the infectious endocarditis, keeping at the same time the same prescription protocol, this prescription being valid in effect for the germs of dental origin.

Since the articular infection is declared, it is obvious that the same strict rules should apply. Extractions are generally necessary. It would therefore be advisable to use the technique of sampling through immersion of the apex to show the germs and to compare them avec those recorded at the level of the articular prosthesis.